Cuvier in Context:
Literature and Science in the Long Nineteenth Century

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I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree.

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This study investigates the role and significance of Cuvier's science, its knowledge and practice, in British science and literature in the first half of the nineteenth century. It asks what the current account of science or grand science narrative is, and how voicing Cuvier changes that account. The field of literature and science studies has seen healthy debate between literary critics and historians of science representing a combination of differing critical approaches. This study asks whether we can continue work to synthesise historicist and formalist approaches, and suggests using a third narrative based approach to achieve a full complement of methodological tools. This in turn should provide more nuanced critical readings. In certain novels it has allowed me to shift the focus on literature and science enquiry to different decades. This study looks for "science stories" from scientific discourses in *The Last Man*, *The Mill on the Floss* and *Bleak House*.

I have demonstrated the centrality of Cuvier to British science in the first half of the nineteenth century and that science's role as a model for the natural and human world, as well as informing the unstable systems of narrative characteristic of the novel genre and form. Cuvier's *Essay* initiated a lasting period of scientific centrality and legitimacy in British science and representation in British novels. His law of correlations applied to geology made his science both an important narrative and analogous to the empirical truth-seeking mode of the novel. The paleontological process becomes both a model for organic unity in Victorian fiction and a mode of narrative production. Cuvier's science and its discourse both produce and are reproduced in nineteenth century novels.

1 Introduction

This study investigates the role and significance of Cuvier's science, its knowledge and practice, in British science and literature in the first half of the nineteenth century. It asks what the current account of science or grand science narrative is, and how voicing Cuvier changes that account. Science is both a body of knowledge and a collection of practices carried out by a science community. Science discourses interact and intersect, so Cuvier cannot be considered in isolation. Instead he must be approached through his science community. This historical line of enquiry has several goals. One goal is to effect a change in any grand science narrative by voicing Cuvier in particular times and particular places. This sensitivity to meta-narrative is engaged through the work of historians of science in the field. Another aim is to interrogate the dominant narrative of Darwin and restore rich heterogeneity to the nineteenth century and to British science, and then locate that science in British literature.

The second line of enquiry is methodological. The field of literature and science studies has seen healthy debate between literary critics and historians of science representing a combination of differing critical approaches. This study asks whether we can continue work to synthesise historicist and formalist approaches, and suggests using a third narrative based approach to achieve a full complement of methodological tools. This multivalent methodology can bring several benefits. First, it must be the goal of any interdisciplinary project to synthesise approaches in a diverse and democratic application of knowledge and practices. Second, a multidisciplinary method using multiple approaches can provide a richer and more nuanced evidence base. This in turn should provide more nuanced critical readings. Third, it will allow the critic to apply suitable methods on a context driven basis encouraging formal close-reading, narrative analysis and historicist detail.

This study uses a narrative approach based on Mieke Bal's three-tiered division of fabula, story and text. This narratological approach can bring several benefits. First, there has been a dominance of historicist scholarship in literature and science studies, balanced by an initial and counter-discourse of formalist criticism. So it follows that a narrative approach can offer new lines of enquiry, especially in combination with the former. Together they offer a potential array of sites of meaning and a powerful toolbox equipped for different modes and moments. Second, the division allows advantages when dealing with novels with several narrators and narrative arcs. Criticism and meaning is often pushed forward to readers and reception or back to author and origins. I read novels using narrative as a means to explore their multi-textuality and rich

temporality. In certain novels it has allowed me to shift the focus on literature and science enquiry to different decades. So new knowledge has been produced, but not of a kind that invalidates previous scholarship.

This narrative approach can be applied to both novel and science discourse, in particular the discourse as a narrative science text, such as Cuvier's *Discourse,* published as *Essay on the Theory of the Earth* in English. Novels and science discourses share many similarities as narrative texts. Intersection and interaction is just as possible through narrative discourse as through science knowledge or practice. This study looks for "science stories" from scientific discourses in British novels. In so doing it has several aims. First, it explores the relationship between narrative scientific texts such as Cuvier's *Discourse* and British novels in the first half of the nineteenth century. Their shared methods and characteristics imply a rich possibility for interchange as dominant forms in their respective fields. Second, it hopes to identify the need for science stories in novels. The novel in its constant pursuit of originality needed new science stories to explain nature no longer seen as "complete and unchanging". Third, the study investigates the cultural and ideological debate and struggle for a legitimate knowledge of nature pointed up by historians of science.

It is a hope that this project might signpost further studies in considering productive syntheses of equally valid yet radically different methodological approaches. In so doing, one always runs the risk of pleasing none of the people none of the time. It is not an attempt to present Cuvier as an alternate structural model for fiction. Nor is it a covert attempt to somehow contest the space in Victorian studies commanded and commandeered by Darwin studies. How does literature and science studies conduct its business? How can we synthesise some of the best work of the last few decades? These are all questions that need addressing by multiple scholars, and the answers will hopefully be as diverse and as enriching as the debate of the last thirty years.

To understand Cuvier's place in the history of nineteenth-century British evolutionary fictions, one must first understand the ways in which literature and science, especially evolutionary science, have been read together in contemporary literary criticism and contemporary history of science. The success of Gillian Beer's *Darwin's Plots* (1983) has defined the study of literature and science for over thirty years. Her study examined Darwin's literary reading and use of language, and how they, in turn, informed his scientific thinking. Her model of two-way traffic between science and literature has led to years of productive interdisciplinary research by literature and history of science scholars alike. However, one perhaps unmeditated byproduct of Beer's success

has been the field's overweighted interest in Darwin. The so-called "Darwin Industry"[1] has been built upon the premise that evolutionary theorising was culturally embedded in Victorian Britain. George Levine's *Darwin and the Novelists* (1988) consolidated Beer's initial work, and the nineteenth century became the enduring focus of the field. Darwin and evolutionary theory epitomised Victorian science, and became the dominant model for exploring nineteenth-century texts. *Origins* was similarly a watershed moment in a cultural account. Next to this towering and heroic figure, there seemed little cultural space for others. This study will focus on the literary productions and practices of another great white man of the long nineteenth century, Georges Cuvier. It does not seek to place Cuvier alongside Darwin as an interpretive model or strategy for reading literature and science. It does, however, seek to interrogate a major figure in the contested space of British science, allowing a broader retelling of the traditional account of Victorian and nineteenth-century science as, at one level, a struggle for legitimacy and authority. Further, Cuvierian knowledge and practices in British debates inform the broader context and contest over natural philosophy that inhabits British novels and fiction in the nineteenth century.

Beer's groundbreaking definition of the relationship between science and literature, later expressed as "interchange rather than origins and transformation rather than translation," ("How Darwin Changes", 142) stressed the two-way traffic between science and literature. In some ways, it was the first step in a contextual, historicist approach where science and literature are of equal cultural value.[2] Beer characterised evolutionary thinking as "embedded in the culture" *(Darwin's Plots*, 2) of Victorian Britain based on the "common intellectual context" model of historian of science Robert M. Young.[3] In the process, Darwin became increasingly central to further work on literature and science. Beer herself has problematised her single-work focus and underlined that any attempt to isolate Darwin from his context clouds our understanding ("How Darwin Changes", 141-142). But both the centrality of Darwin to traditional accounts and the homogenous one-culture model of nineteenth-century science have been questioned by historians of science. Beer has described *Darwin's Plots* as an "enquiry into how we can ever reach new ideas in language, that medium so loaded with history and with communal assumptions". ("How Darwin Changes", 142) Beer's ostensibly contextualist and literary historicist approach, however, belies an enduring interest in the significance of the "fleeting and discontinuous" (*Translation or Transformation?* 81). To historians of science this implies that abstract ideas may then escape their contexts and that values

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[1]Flannery, "The Darwin Industry."; Ruse, "The Darwin Industry: A Guide."

[2] See Greenblatt, *Renaissance Self-fashioning: From More to Shakespeare*, for the seminal work in this field.

[3] Young, *Darwin's Metaphor: Nature's Place in Victorian Culture*, 126.

and ideals may be reformulated in other times and spaces. Darwin thus generates meaning that can traverse context; meaning that can then be diffused as a trickle-down effect from centre to periphery. In other words, a persistence in literary analysis might produce and support grand narratives that a historiographical approach recognises and resists, or at the very least recalibrates. The Darwin "fallacy" therefore is enhanced by disciplinary attention to literary values that support a traditional account of both literature and science. This is not to attack Beer, whose approach to literature and science studies emphasises its specific temporality and spatiality, both highly contextually bound:

> Neither literature nor science is an entity and what constitutes literature or science is a matter for agreement in a particular historical period or place. The activities of scientists, and their social and institutional bases, have changed enormously over the past 100 years. More, on the face of it, than those of the writer of literature. (*Translation or Transformation?* 81)

Secord and Topham have since argued that textual meanings are generated by readers, not by their authors.[4] If meaning is not intrinsic to Darwin's texts and bound to authorial intention as per formalist approaches, then how can his ideas be diffused textually other than through its readers? It follows that the common readership creates the interaction, the intertextuality of literature and science. This thick description approach may contradict views of literature, and particularly the novel form, as a quest after the ideal and the universal through the prism of the individual and the particular.[5] Harold Bloom famously argued that New Historicism made literature a footnote of history.[6] However, literary historicism aligned with the historiographical approach of history of science offers new and highly nuanced insights in interdisciplinary studies. If formal critical approaches deriving from New Criticism pay attention to language and structural features help point toward the nuanced ways in which literature interacts with science, historiographical approaches remind readers that texts are culturally bound to particular times, places and reading practices.

James A. Secord's *Victorian Sensation* (2000) offers a seemingly unparalleled thick description account through a history of books approach examining historically specific reading practices.[7] Gowan Dawson equates reading with other physical activities such as fieldwork, lab-work and by extension writing or literary production. ("By a Comparison of Incidents and

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[4] Secord, *Victorian Sensation,* 518-519; Topham, *Scientific Readers,* 431-442.

[5] See essay: "Thick Description: Toward an Interpretive Theory of Culture" (1973). Geertz cites philosopher Gilbert Ryle's lecture "What is *le Penseur* doing?" as the source of the term.

[6] For Stephen Greenblatt's take on Bloom's argument see Greenblatt's blog: http://www.shmoop.com/stephen-greenblatt/comrades-rivals.html.

[7] See Price *How to Do Things with Books in Victorian Britain;* Finkelstein, *An Introduction to Book History;* Johns, *The Nature of the Book: Print and Knowledge in the Making.*

Dialogues", [3]) Reading is a physical activity occurring in a specific time and place. This focus on practices, rather than ideas or theories, connects the reading of men of science with their other activities. This approach provides a clear evidential robustness in limiting what can or cannot be said about texts and their meanings. At the same time, it offers new perspectives for the literary scholar to explore. Dawson suggests a dual shift away from Darwin and toward focussing on reading as a material practice, while retaining Beer's detailed exploration of poetry and fiction in reciprocally helping develop scientific thinking and ideas. ("By a Comparison of Incidents and Dialogues", [25]) The historicist movement—that away from author-mandated meaning and the charting of abstract ideas, and toward reading practices—interrogates Beer's assumptions about science and literature in context. Traditional accounts of science depict practitioners as "discovering truth," in classic eureka style, as if it existed in a cultural vacuum beyond any specific temporal or spatial context. In this scenario, science is privileged in interacting with universal truth unburdened by troublesome value assumptions and cultural contingency. If, however, knowledge, and by extension science, is culturally conditioned and produced, then this grand narrative of heroic discovery—"the science epic"[8]—must be in turn produced by an examination of scientific practices in local contexts. Science and literature are then similarly culturally contingent, and historians of science have been quick to see the opportunities for interdisciplinary work in adopting the methods of literary scholars, in particular book history and reader response. (Dawson, 'Literature and Science under the Microscope', 304)

Beer's cultural embeddedness (*Darwin's Plots,* 2) draws on historian Robert M. Young's 1960s thesis of the "common intellectual context" of mid-nineteenth-century Britain. Young proposed this "common context" to be a richly interconnected verbal and theoretical culture where science and theology, poetry and politics, all intermingled with great productivity and mutual cross-pollination. This metaphorical melting-pot of interdisciplinarity props up "the science epic" of disparate elements pulling together in a common cause, heterogenous becoming homogenous in one culture.[9] The interplay with Beer's contention that evolutionary theorising and thinking permeate Victorian society is self-evident. The one-culture or common-context position agrees with a traditional diffusionist account of science and Imperial Victorian Britain. Historians of science have questioned this "common context" model, instead reviving the rich heterodoxy of the nineteenth century. The traditional account or story of science is one of professionalisation and specialisation

[8]The science epic is a term that arises infrequently to describe the broader project of the science community in practicing science and, ultimately, producing a body of knowledge. In other words, the pursuit of truth.

[9] Topham, "Beyond the "Common Context": The Production and Reading of the Bridgewater Treatises", 233-234, for an explanation of the "common context" model.

in forming distinct disciplines. The unifying force of this originally heterogenous milieu is the gentlemanly elites imposing hegemony from centre to periphery. Knowledge is therefore produced at the culture's centre and "diffused" in a trickle-down effect to the outer margins. Diffusionism perpetuates a story of science easily abbreviated into the lives of a chosen few pivotal names, much akin to that still taught in schools today.[10] Historians' of science critique of diffusionism stresses that success in science is contingent on debate.[11] Science practitioners carve out cultural spaces in order to forge careers. In this sense, science *is* contested space. It follows then that we should engage concurrent debates in order to appraise nineteenth-century science. At the same, historians have pointed up the significance of nineteenth-century practitioners themselves being unsure of just who were "scientists".[12] This uncertainty about what the nineteenth-century scientific community actually was contradicts the relative clarity of a modern diffusionist account. If the labels applied to actors and practitioners are inaccurate, it has been argued,[13] then how can we trust those applied to activities and practices. Indeed, the whole story of science appears to be a construct. Morus summarises nineteenth-century science as "the outcome of a whole series of local debates about the locus of institutional and intellectual authority in a variety of contexts" ('Replacing Victoria's Scientific Culture', 4).

If science is contested space, then scientific authority equates to political power. The model of diffusion from centre to periphery of the "common intellectual context" must shift from static homogeneity to dynamic heterogeneity characterised by struggle for power. This struggle has been geographically relocated from centre out toward peripheries; it has been concretised from abstract ideas to physical practices, and to contested spaces inhabited by debate. The traditional diffusionist account, moreover, lends a particular perspective to the story of science by its start and end-points. In the beginning of the tale, natural philosophy is in the hands of a liberal Anglican elite "confounding both conservatism and radicalism in religion and politics" (Morus, 'Replacing Victoria's Scientific Culture', 12). This gentlemanly elite then "reforms" our understanding of nature, analogous to the Great Reform Act, precipitating the one-culture conquests of science in the latter part of the century. Morus proposes an alternative temporal perspective starting from the French Revolution in the 1780s and 1790s. ('Replacing Victoria's Scientific Culture', 13) Instead of

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[10] See Rogers, *Diffusion of Innovations.*

[11] See Secord, "Knowledge in Transit," 654, for the issues related to the process of the field and large-scale narratives of science.

[12] See Moore & Desmond, "Transgressing Boundaries," for a discussion of Whewell's neologism which only became popular in the 1870-1880s.

[13] Dawson and Lightman, *Victorian Science and Literature, General Introduction, x-xi.*

a successful ameliorative struggle by elite classes to mollify extreme elements, both radical and reactionary, in Britain, we see an unstable and dangerously heterodox English natural philosophy. Influenced by continental practices with radical and revolutionary strains, science could be a conduit for revolution into Britain.[14] Science as a cultural and contested space was a political battleground for nature, and for the politics of nature. On the one hand, the reordering of science and scientific spaces signalled a break from a revolutionary past. For other practitioners, it was a chance to reassert the radical legacy of natural philosophy. In short, we are left with a politics of nature. Scientific knowledge conferred power and authority, and what greater power than to understand and speak on nature's behalf? Science as a mode of knowledge production contributes to the creation of both cultural and political hegemony, and nature was a critical site and space for debate and struggle for legitimacy.

George Levine has pointed up the problems inherent in trying to reconcile historicist and formal criticism. ('Reflections on Darwin and Darwinizing', 232). For formalist-leaning critics such as Levine and Beer texts may have "fully intrinsic meaning" (232). Secord's contextualism moves meaning away from mandated authors and toward the reader and is therefore in obvious contraposition. Both Beer ("How Darwin Changes") and Dawson ('Literature and Science under the Microscope') find more common ground in a combined approach, where meaning can be intrinsic to different spaces and different approaches. Levine takes issue with Secord's assumption that "science is determined primarily if not exclusively by political and ideological forces" (238), describing it as "de-heroizing literary history" (238). Formal or aesthetic criticism may favour intrinsic textual meaning and thereby perpetuate a traditional, heroic grand narrative. This staunch individualism, however, may also be its most persuasive trait. In finding a synthetic approach to literature and science studies informed by the post-Beer work of historians of science, the issue of individuality appears critical, especially when reading novels. According to Ian Watt, and other historians of the novel, the novel as a form, is predicated upon realism.[15] That realism, in turn, is based upon the experience of the individual in very particular, specific circumstances. There may well be a relationship then between any renewed account of the practice of science based on recent work and the development of the novel in a similar period informed by scientific practice.

Levine argues that Secord exemplifies Darwinian gradualism by reading subject back into deep context and characterises recent historians of science as "anti-catastrophist" (232). The novel

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[14] See Desmond, *Politics of Evolution: Morphology, Medicine, and Reform in Radical London; "Artisan Resistance and Evolution in Britain, 1819-1848."*

[15] See Watt, *The Rise of the Novel*, 31-34, for formal realism in the novel.

as a form makes everyday experience the base unit of our culture; even heroes are humanised due to its thoroughgoing individualism. Dissonance prevails between the individual lost in rich context and the individual lionised in grand narratives. But does it follow that this continuum is strictly two way? Moreover, can a broad historiographical approach from history of science help re-focalise the slippage on this treacherous continuum? One potential mid-point between finding meaning fully intrinsic in the language and intent of the author, and reading meaning away from the author toward contemporaneous reader and context is to locate it in the world of the novel; a locus from where meaning may be traced out into different spaces and different times. This would equate to the third site of meaning between reader and author attributed to form in structural approaches such as narratology. The critic resolves the conflict of historicist, formal and narrative approaches by applying all in appropriate measures. The author has opened a portal to private experience that makes overarching historical detachment difficult at best, however, historians of science remind us that overarching grand narratives still matter, because grand narratives filter through the discourses of cultures, authors, and individual readers. Private experience makes scientific narratives, just as scientific narratives affect private experiences at particular historical moments. In the end, we must recognise the significant differences between the job description of the literary scholar and the historian of science, while attempting synthesis and sensitivity in interdisciplinary study.

Gowan Dawson provides roadmaps for a synthesis of approaches while still utilising reader response and book history methodology. His *'Show Me the Bone': Fossils, Palaeontology and Prehistoric Creatures in British and American Culture* consolidates research that suggests there are equally useful models with which to understand nineteenth-century fiction that can be drawn from its science. Dawson proposes palaeontology and Cuvier's law of correlation as a potentially pervasive model unifying nineteenth-century fiction. (*Literary Megatheriums,* 227-228) By tracing textual meaning out toward readership he highlights the significance of serialisation as an underlying structure in Victorian and nineteenth-century novels. Serialisation as the prevalent mode of publication suggests structural affinities not with Darwin, but with Cuvier and palaeontology. Levine and Beer had uncovered not only Darwinian plots in literature, but also feeder debates such as the uniformitarian-catastrophist dialectic.[16] However, the approach, through aesthetic and formal criticism, was founded upon acceptance of the initial proposition—that Darwin and evolutionary thinking did indeed permeate the culture of Victorian Britain—based on Robert M. Young's "common cultural context". Dawson, in contrast, demonstrates how supposedly "lesser" figures in

[16] Levine, *Darwin and the Novelists: Patterns of Science in Victorian Fiction*, 135, for a clear exposition of this position.

the traditional account of nineteenth-century science could provide potentially more effectual models. In retrospect, Beer and Levine's studies need to be supplemented by a more nuanced reading that incorporates other kinds of evolutionary narratives and plots. Dawson's reasoning shows some of the ways that recent historians of science are learning how to escape from the meta-narratives of their own field. Historians of science and their practice may help literary scholars map out clearer evidential cases. Cuvier's work does not provide a simple model for nineteenth-century fiction. Instead in this study I show that there are interactions between the science stories contained in Cuvier's narrative texts and those incorporated in British novels. However, these stories continually contest and compete with other voices, and other stories and other practitioners.

Correctly angling this study was a struggle. Part of the reason for this was the lasting awareness that my principal subject, Baron Cuvier in his last guise, would have insisted on empirical evidence of which there was little. I struggled with concepts such as influence and dissemination of ideas with good reason: short of a direct nod, rather like Herman Melville's footnoting of Cuvier in *Moby Dick* or Byron's in *Cain*, there was little empirical data that would have satisfied Cuvier. Therefore this study is not a direct attempt to trace the ideas and influence of its subject. It is rather an attempt to map the context in which they might have been practiced. Dawson's idea that Cuvier's law of correlation could be proposed as an equally effectual structure for Victorian fiction demonstrates how Cuvier can be used as a pre-Darwinian model. Without question, the extending of the temporal context and overarching historical meta-narrative to include the long nineteenth century and the French Revolution was an effective point of departure. Cuvier immediately belongs to the context, instead of being an eighteenth-century doyen shoehorned into another time, place and culture. Moreover, the reassessment of science as contested space determined by political and ideological forces makes sense of my focus on a French naturalist in British fiction. Already the context has shifted; Cuvier's part in the politics of nature makes the extended timespan necessary and places him at the heart of British scientific debate. How then to trace his science as both practice and knowledge as it is put to work elsewhere?

Science Knowledge and Practice

In these introductory sections, I have assessed the state of literature and science studies, and reviewed previous criticism in the two main disciplinary fields involved in this project, and the main methodological approaches of its major exponents. I have attempted to define the broad literary approaches of, on the one hand, formal criticism coming from the New Criticism, and, on the other, literary historicism from New Historicism. These have been contrasted with the major

work done in the field by historians of science. Not only have they adopted literary techniques, but they have also reintroduced a concern for meta-narrative and how it then interacts with literary formalism and historicism respectively. I have pointed to the division of the assignment of meaning in literary approaches to author and reader in these respective strategies. However, further structural approaches such as narratology assign meaning to form as a potential third site. It is this third site I intend to point up in order to investigate a working interaction between these various approaches discussed above. This should then in turn facilitate analysis of the relationship between science and literature as they intersect as narrative texts.

It is my aim to address the questions and goals of each part of the thesis at the beginning and the end of each chapter. My first and principal question is relatively broad: What is the role and/or significance of the knowledge and practice of French naturalist Georges Cuvier's science in British science and British fiction in the first half of the nineteenth century? Published in English from 1810 onwards, the main scientific discourse to be considered here is *Essay on the Theory of the Earth* (1813). His various works were then published and re-published through the period and onwards. However, the works of fiction analysed are published from 1826 through to 1861. This presents an interesting conflict. If George Eliot's *The Mill on the Floss* is published in 1861, in what way can we investigate the role and significance of Cuvierian knowledge and practice during the first half of the nineteenth century? I will suggest that *Mill* at the narratological level of story has a setting and therefore context in the 1820s and 1830s, one which persists even if the story is recast in another time and place. By investigating this specific context I demonstrate the intersection between the two narrative texts.

To understand the role that Cuvier's science played in literature of the time, it is important to lay out the role that the knowledge and practice of Cuvierian science and competing knowledges and practices played in print and public arenas. Cuvierite advances in the fields of palaeontology, comparative anatomy and their application to the field of geology do not exist in isolation. On the contrary, they develop alongside other competing practices of science such as Lamarckian transformism, without which we would not have the dominant Darwinian evolutionary focus of the field of literature and science studies. In order to investigate the proposition, in this thesis I contextualise Cuvier within a framework of competing or contributory practices of science. The totality of these individual narratives of science produce the grand science narrative to which historians of science have drawn critical attention. By exploring and "voicing" or lifting up Cuvier's role and the significance of that role in the grand science narrative, I hope to produce a more detailed evidence base for further investigation. The dominance of a single science story and

theoretical method such as that of Darwin in literature and science studies cannot produce a balanced view of history. This constitutes a detailed, contextual approach to Cuvier studies, but reconciled with an overarching historical scope. The goal is to lift up these competing and interplaying practices and narratives in order to close-read British fiction with a more nuanced and richer evidence base. In doing so I hope to combine historicist and formal approaches in a unified strategy that produces a rich contextual basis, while allowing for traditional formal reading of texts and retaining balance at an overarching historical level.

Formalism and Historicism

My second main research question is as follows: Can the two dominant approaches to literature and science studies I have considered be successfully combined? Let us consider the outline arguments of both of these highly successful strategies. The historicist argument of historians of science that I have pointed up contends that literature and science inhabit the same contested space of, here British, culture. Science and literature are both valid modes of knowledge production and important components of the totality of British culture. Moreover, they both share a common goal in trying to describe and understand the human mind and the natural world. Knowledge of nature produced by both science and literature does not exist in a historical vacuum but belongs in specific times and places. The knowledge produced then is not pure, but political. These modes are part of a cultural struggle to produce legitimate and authoritative knowledge and narratives of nature, which Morus (‘Replacing Victoria’s Scientific Culture’, 13) has described as the cultural struggle to speak on behalf of nature. Political power and hegemony may offer limited control over nature. Science, on the other hand, offers practical power over nature which drives both political and economic enterprise in the period. But literature, and the science it reproduces, acts as a significant component in the soft control of cultural hegemony. In this regard, both science and literature produce knowledge and narratives that contribute to and resist dominant ideological forces. They both produce knowledge about nature, they both tell stories that explain our world.

The formalist argument takes a different methodological position allowing for de-contextualised pure knowledge to exist. Both the critical and amateur reader responds to the language of cultural texts—and, in this study in particular, to novels—by close reading with special attention to language without any thoroughgoing application of external context. In some sense, we all understand the project of close reading as a baseline skill in literature studies, and even most historicist studies will inevitably close-read texts and recognise authorial intention and meaning. This thesis does not aim to address all the complex and various problems related to formal criticism.

But will engage in close-reading where appropriate, as all these different sites of meaning and contextualities are legitimate. The work of the scholar in an interdisciplinary study is to apply different methods and approaches where useful or successful. So this study will embrace a narrative approach that is certainly not dominant in the field of literature and science studies. It may allow a greater degree of agreement between two historically divided sides of a debate that have thus far led to antithesis not synthesis.

The goal of this process is to voice Cuvier in the British context and, as a result, read his voice in the British literature of the period. But not only his voice, but those that oppose or compete with him; those that hear his call and those that answer. If we are attempting to revise any traditional existing account by raising awareness to and of one particular practitioner (a science writer, an administrator, a public speaker, a natural historian and philosopher, a savant), then we should be aware of a similar effect to that perceived imbalance already existing in the dominant account. If Darwin commands too much space, then voicing any other single science and cultural practitioner will have similar distorting consequences. In hoping to voice Cuvier, we must remember that in producing knowledge from our specific context a shift in the grand narrative occurs. A rigorously critical discussion of assumptions and conclusions drawn or accepted must be driven ever forward. Moreover, the contextual perspective of the cultural and literary critic is constantly shifting and creating new forms of contextuality, inviting new modes of understanding, and producing new knowledge in new modes.

Narrative Approaches

Having elicited the goal of successfully combining formal and historicist approaches within the study of literature and science, the third generally accepted point of meaning must be discussed. Narrative approaches find meaning in structural elements of form. Formalism's context is creation, a literary *the-making-of* mode wedded with the doctrine of "text itself", while historicism's context is interaction of the text as artefact with the material world and its cultural readers. My reason for incorporating narrative approaches is to develop an intersection of form between narrative texts in science and literary novels. Thomas Kuhn's *The Structure of Scientific Revolutions* (1962) pointed up the rhetorical nature of scientific discourse. Novelists engaging in their own linguistic narrative processes might well draw from scientific knowledge and scientific plots and forms. The question we can elicit then is whether the similarity in narrative processes between scientific discourses and novels might lead to science stories being appropriated into novels in their need for original

representations of nature. Moreover, we might ask whether those science stories have not already intertextually incorporated or appropriated existing stories or myths.

So, what is my narrative approach? This study applies a three-tiered division of form into fabula, story and text as set out by Mieke Bal (*Narratology*, 6). The reason for this functional definition is its superficial analogy to sites of textual meaning of author, form and reader discussed above. These overlapping and imperfect working divisions offer symmetry to formal, structural and historicist approaches. I am not suggesting a neat and discrete separation exists beyond a working model. But the binary pairings of author-fabula, form-story and reader-text serve to highlight the different possible and potential contextualities. Moreover, they serve to refocus this critic's attention to science stories contemporary to the temporal setting of the novels. If, as Watt insists, novels are about "particular individuals having particular experiences at particular times and at particular places," (*Rise of the Novel*, 31) then the particular temporal and spatial setting of the element of "story" is worth critics' attention. For example, when Adeline Buckland in *Novel Science: Fiction and the Invention of Nineteenth-Century Geology* (2013) interrogates Eliot's *The Mill on the Floss* through the methodological debate of the 1860s, she is investigating a particular historical context. I suggest that *Mill's* contexts might expand to other competing science stories of the 1820s and 1830s. This does not in any way make Buckland's analysis invalid, but points out the ways in which competing scientific discourses might intersect at a narrative level in a literary novel.

Cuvier's *Discourse* later published in English as *Essay on the Theory of the Earth* (1813) is our primary example of science discourse as narrative text. It uses literary techniques in narrative form. Moreover, just like a novel, it organises and reorganises raw material (fabula) into a coherent story. Cuvier has a rhetorical aim in producing what I call his "science story," which intertextually and reflectively interacts with traditional science and biblical accounts, but simultaneously resists and reconfigures them. So as a narrative text it behaves in similar ways to a novel. The *Discourse* was published separately to its attendant scientific proofs, giving it independent status as a narrative text. Even though I intend to survey Cuvier's publications up to the *Essay* (1813), it is specifically the *Discourse* that presents a science story as narrative text, and, as a result, may be a logical intersection between the practices and knowledge production of science and literature.

I hope to test the usefulness of a narrative tactic within my broader strategical approach. That broader approach is to effectively place formal and aesthetic methods of close reading and attention to language within the overarching project of a rich historicist and historiographical approach to the field's evidence base. However, there is also a clear interpretational division in the assignment of the location of meaning within the literary text. The traditional literary approaches,

which include both the formal and biographical, locate meaning in the author and the author's intention and mental states. At the same time, formal and biographical criticism pushes meaning both spatially and temporally to the fabula or the crude material of a sequence of events, within a narratological breakdown of fabula, story and text. In contrast, contextual history-of-science approaches derived from New Historicism push meaning out to text and readers, a constructivist approach that favours groups and communities over individuals. But I suggest that "story itself" provides a third site or locus for meaning, one that may feel structurally aligned with aesthetic method but could, in effect, unite the two approaches that constitute lines of debate in contemporary critical practice.

By adopting a narratological methodology dividing narrative into fabula, story and text after Mieke Bal (*Narratology, 6)*, I hope to focus on the context embedded in the story element of the texts. In all our novels this means a refocusing of the critical eye to the timeline organically embedded in the story. This, in turn, is in contrast to criticism that either i) focuses on the author, the author's intention and how the author has selected material (fabula) for the novel, or ii) focuses on the reader, the text's reception and how the practice of reading ensues (text). The first focus of biographical and formal or aesthetic criticism centres critical attention to the period of the author's life, which is an entirely valid mode of inquiry and may even be the same or very similar to text reception on initial publication. Formal criticism, of course, reads the text as a single integrated organic whole. It promotes pure knowledge in a traditional mode of production. But nearly all formal criticism that close reads texts necessarily faces backward temporally toward the author's mental state and intention at its time or period of origin. The second focus on text finds meaning in the events that follow text publication and reception by readership. This is the text as artefact after publication of any single version, edition, or interpretation in other media. But I argue that a focus on story, rather than fabula and text, allows a possible intersection of these two positions. Or at least invites the critic to a potential if poorly defined area between and adjoining both. In doing so, texts like *The Mill on the Floss* written in 1861 are considered as story in their own context, in this case the late 1820s into the 1830s. What does this mean? Well, between authorial intention and reader reception is a third position of meaning that might inhabit the others simultaneously. The story exists in and of itself post authorial creation and refinement. It also exists before its mediation as a cultural text and subsequent passage into reader reception. In the space in between the story prevails. Hayden White writes, "far from being one code among many that a culture may utilise for endowing experience with meaning, narrative is a meta-code, a human universal on the basis of

which transcultural messages about the nature of a shared reality can be transmitted".[17] While the two narratological bookends of reader reception and authorial intention are both important to this study, its focal point is on the space in between, which Bal defines as story. However, the story is not simply a de-contextualised structural component. On the contrary, I argue that story should be re-contextualised, or perhaps it is clearer to state that it already is and always has been. I hope to investigate how exploring and utilising the story's context can help us synthesise two antithetical approaches in a project of quantum synthesis focusing on narrative structures. I also hope it will open up new perspectives for critical attention in exploring the intersection of scientific discourse and the novel.

The Nineteenth Century Novel

The final question I ask is what is the relationship between science, science knowledge and science narratives and the nineteenth-century novel? Many critics note that the novel shares a similar outlook and methodology with scientific enquiry.[18] Emile Zola says that the experimental method of science can "also be carried into the naturalistic novel", and he goes on to cite Cuvier in the following paragraph.[19] The novel could indeed be a form aligned in its modernity with the scientific revolution. Both Watt and McKeon emphasise the novel's links to empiricism. Its relationship to traditional practice and plots stress originality and the production of new knowledge rather than the confirmation of old wisdom. Watt (*Rise of the Novel*, 14) writes that before the novel: "since Nature is essentially complete and unchanging, its records, whether scriptural, legendary and historical constitute a definitive repertoire of human experience". It follows then that if nature does indeed change that new records would be needed. So novels, not only align with scientific method as a process, but also need new knowledge and new narratives of nature in order to meet this changeability. According to Watt, in its drive for renewal and originality in representing nature no longer "complete and unchanging," the novel rejects traditional plots and seeks out new explanations and narratives. In this respect, the narrative texts of naturalists share the method and aim of constant renewal with the novel form. Benedict Anderson stresses that the novel is just another mode of modernity, and that literature and science, both as a body of knowledge and as

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[17] White, *The Content of the Form: Narrative Discourse and Historical Representation*.

[18] Zola, *The Experimental Novel;* Watt, *Rise of the Novel;* McKeon, *Theory of the Novel.*

[19] In Kettle, *The Nineteenth Century Novel*, 300.

narrative texts, share similar interests and forms.[20] Cuvier's *Discourse* published in English as *Essay on the Theory of the Earth* (1813) is a narrative text displaying literary features. This may not be surprising considering the heterogeneity of knowledge and knowledge production before the professionalisation and specialisation of academia and knowledge centres in the nineteenth century (Gibbons et al, 1994). While science practice stresses replicability, its narrative texts must lead to new understanding. In this sense, the narrative texts of science carry "science stories" just like novels themselves. Moreover, just like novels in their continuous pursuit of modernity and originality, science stories self-reflectively incorporate the old, while constantly pursuing the new. Watt (*Rise of the Novel*, 22) underlines that the novel is the only genre or form that does not date from antiquity and therefore shares a modern historicity with the science and print revolutions, and Protestantism.[21]

So, in reading Cuvier as a narrative text, I hope to distinguish between science knowledge which might be freely adapted for use in a literary work, and science stories embedded in narrative text. The science story is a narrativisation of the science knowledge that may then be useful to the novelist. For ease of identification the term "story" will be used for the reordering of the base fabula, data or knowledge in narrative texts of both science and literature. If Watt's contention that the novel is the only new genre or form holds, then this shared aspect of modernity combined with rich cultural heterogeneity make science stories ways of portraying nature no longer "complete and unchanging" (*Rise of the Novel*, 14) formally akin to the novel. This does not mean novelists will appropriate science stories wholesale. On the contrary, the novel as a form subverts traditional plots and it is my contention that all the novels in this study embrace science stories in their own process of seeking originality. Watt (*Rise of the Novel*, 31) describes that process as "a developing but unplanned aggregate of particular individuals having particular experiences at particular times and at particular places". The novel then stresses "the primacy of individual experience" (*Rise of the Novel*, xxx). A narrative approach can sit well with projects of pure historicism or formalism. Interdisciplinary approaches naturally seek to test syntheses. I hope to combine elements of several approaches. First, formal close-reading of the language of the "text itself" and its preoccupation with the time and place and process of creation, locating meaning in the authorial intention—the choosing of the fabula and the making of the story. Second, historicist contextualism and its foci of the textual artefact and the reader creating meaning through the practice of reading—this is the text

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[20] From Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism,* in McKeon, *Theory of The Novel*, 414-434.

[21] Also McKeon, *Theory of the Novel,* 385-7.

as publication and as any following cultural reprise. Third, the narrative structural approach that finds meaning in form—here using Bal's three-tiered division of fabula, story and text. All these contexts feed into a literarily nuanced approach and toolbox. I want to investigate if there is a connection between science stories in scientific and literary texts. You might call it novel discourse: the former being the emergent narrative text of nineteenth century Britain, the latter the narrative text preceding proofs in science publications.

Outline Structure

Chapter II establishes Cuvier's career and activities in France; his journey from periphery to the centre of world science at the *Muséum* in Paris. From there it maps Cuvier's science and its practice and counter-practice through the international science community and into various cultural milieu. This study focuses on its continued practice and its success in producing and modelling knowledge about the world in Britain and British culture, and in British novels in the first half of the nineteenth century. Cuvier is considered in particular in relation to his predecessors and contemporaries, many of whom were expounding grand, unifying schemes of earth history, so-called "theories of the earth", that reconcile the latest knowledge in natural history with traditional Christian accounts. Cuvier came to Paris after the Revolution's purge of aristocratic patronage, so he did not need to placate a noble mentor. In contrast, however, he did have to assert himself in carving out a career path at the potential expense of friends, colleagues, and, in time, adversaries. This chapter addresses our two historical, descriptive research questions. It prepares the ground for the first in asking what was the role and significance of Cuvier's science in context, in terms of practice and counter-practice. In nuancing any broader account of the history of science we must detail and include both competing and complimentary narratives of science, and as a result ask questions of science as narrative. Moreover, these naturally lead to questions about the nature of narrative texts and the links between these disparate "science stories" and the rise and development of the novel before the institutionalisation of English Literature as academic practice in the second half of the nineteenth century.

Chapter III reads his literary productions up to 1803 and the advent of the First French Empire. In reading his textual productions as scientific practices, evidence is considered from papers on anatomy, fossil anatomies, geology and correspondence. No reader response analysis or book history is employed to trace publication and physical production, or his readership and reception of his works. Cuvier's own reading and how it may effect his own literary production is not considered following Beer's classic two-way model. However useful such an analysis might be,

and definitely encouraged for further study, it has been foregone for various reasons. Primarily because this study reads Cuvier from French into British cultural space and scientific debate—then, from that broad and rich cultural context, back into the textual, literary productions of British novelists. The two-way and reflexive input-output model of Beer is revised. In its place Cuvier's textual productions feed from French to British culture, into the literary productions of British novelists. As a result, textual evidence is privileged reflecting the superordination of literature to science in this study. Though meaning is not read back from subject to reader, it is not considered intrinsic to text and Cuvier.

One problem with such an approach is that Cuvier produces conflicting texts in different contexts. We therefore meet a different Cuvier in different times and different places. If science is determined by political forces then this first period of the Revolution and Revolutionary Wars must define Cuvier's politics of nature. Moreover, he engages in professional debate and conflict in order to secure his own future career. He first establishes himself in contradistinction to his illustrious predecessors, then asserts himself over contemporaries. The complimentary and competing "science stories" of the previous chapter are read in Cuvier's differing, contextually and historically contradictory positions at different times in his life and writing. They equate to competing ideologies in a cultural analysis and stand as such here. In order to separate the political process of struggle for professional legitimacy from the science story doing primarily cultural work in representing the world and worldviews, I begin to apply a distinction of fabula, story and text to Cuvier's productions. This in turn produces questions of the relationship of science discourse as narrative text and its appropriation into novels.

Chapter IV continues to read Cuvier's major publications through the Napoleonic Wars and into the Bourbon Restoration. Cuvier is in cultural and political ascendancy, engaged in policing the boundaries of proper and acceptable science during the Empire and then the return of the monarchy. The textual readings continue to bring us closer to our subject and context, treating natural history writing as literary production. During this period Cuvier's writings are translated and distributed beyond just the international science community. The usefulness of mineralogical texts to the mining industry and trade in general is the chief driver in this process. But these "hard" political benefits must be distinguished from the "soft" cultural work also done in scientific discourse. The factual base or raw data of any science practice becomes loosely analogous to the fabula of literary productions. The text is the production in publication mediated to an audience. As we shall begin to describe in subsequent chapters the cultural and political work done by Cuvier's science can be due to it being recast and shoehorned into new or competing narratives.

Chapter V relocates geographically to Britain from the initial publication of *Essay on the Theory of the Earth* (1813). Cuvier is integral to the development of British palaeontology. Again, the study does not engage in book history or reader response analysis. Because this study embraces a wide sweep of history, it cannot engage in this way with the readings of Cuvier at the level of micro-detail. However, it is hoped that further studies might fill in the spaces left unfilled. The historical context of Cuvier in Britain is, nonetheless, critical to this study. While the spectre of revolution loomed large in pre-evolutionary theories of transformation and transmutation, Cuvier's functional approach provided an effective middle way for a succession of competing "British Cuviers," an epithet ascribed to nearly all of our practitioners. Methodologically, I continue to use a narratological strategy and structural division of fabula, story and text after Bal. The goal is to isolate the "science story" component. As Cuvier's science spreads geographically, new practitioners employ him in hegemonic struggles between competing science ideologies. Moreover, his particular "science story" merges with literary story in Byron's drama *Cain: A Mystery* (1821).

The following chapters examine three major novels of British fiction from 1826 through to 1861, interspersed with the Cuvierian practice and counter-practice in British science in the 1830s and 1840s respectively. Chapter VI reads Mary Shelley's *The Last Man* for intersections with science discourse. *The Last Man* has not received much critical attention in the field of literature and science studies. Moreover, its form as early science fiction means that the story's context is rich in temporality. The science stories of Cuvier and James Hutton intermingle with biblical myth in Shelley's romance. They are the fabula reorganised in the story of *The Last Man*, which acts as a test case before taking on Victorian novels. Various critical texts are interrogated in the reading. James Secord's call for reassessment of editor of *Essay on the Theory of the Earth* Robert Jameson's practices and positions in the historical piece *Edinburgh Lamarckians* (1991) is used to question traditional readings of Cuvier in Britain. Ralph O'Connor's interdisciplinary *The Earth on Show* (2007) provides useful evidence for Cuvier's initial narrative use in *Cain*, Ian Watt's *Rise of the Novel* (2001) and various other theory-of-the-novel critics are engaged in reading the romance novel's rich context.

Chapters VII and VIII move on into the 1820s and 1830s, and to a critical reading of George Eliot's *The Mill on the Floss.* The historical work of Adrian Desmond on Lamarck and Grant, and James Secord's literature-and-science masterpiece *Victorian Sensation* (2000) and work on Charles Lyell are engaged in both representing science discourse in Britain in the period, as well as interrogating George Eliot's text. Lamarck, Lyell and the project of the Bridgewater Treatises all interact with Cuvierian knowledge and practice. Moreover, Beer and Levine and Sally

Shuttleworth's *George Eliot and Nineteenth-Century Science* (1984) are engaged as part of the first wave of literature and science criticism from the 1980s. In addition, modern critics who moved the field on are engaged and interrogated. Adelene Buckland's *Novel Science* (2013) engages and updates earlier critics, but moves focus on *Mill* to methodological debates of the 1860s. I suggest that at the narrative level of story the science context is of an earlier period; a period which may be just as useful for critical readings of the text. This "novel discourse" is then redirected to intersect with novel theory.

Chapters IX and X move us forward to the setting of Charles Dickens' *Bleak House,* which plays out in London in the 1840s. Again, the focus shifts from the 1850's textual artefact to the actual context of the story in the 1840s, giving a fresh perspective for the critical gaze. Much work has been done on Dickens, like Eliot of course. Historian of science Adrian Desmond trains our gaze to the fierce anatomical debates in Britain in the 1840s, between two would-be British Cuviers Robert Grant and Richard Owen. Owen's invention of the *dinosaur* in 1841 is tied to the first image of the *megalosaur* in *Bleak House's* opening. Beer and Levine's *Darwin and the Novelists* (1988) are critically engaged from the original 1980s literature and science criticism. In addition, J. Hillis Miller's classic *Charles Dickens: The World of His Novels* (1958) still provides insight in its close reading of Dickens' text. Finally, Gowan Dawson's serialisation thesis developed in *Literary Megatheriums and Loose Baggy Monsters: Palaeontology and the Victorian Novel* is brought up to date in *Show Me the Bone* (2016), released between draughts of this thesis. At every stage of this study we can expect to meet a different Cuvier in different times and in different places. His science stories interact with those of contemporaries in the rich heterogeneity of French and British culture. Those science stories become narrative texts in scientific discourses. Indeed, narrative skill engenders success as a science practitioner. This study will seek to trace Cuvier's science stories, and those with which they are interlinked, into the representations of nature in British novels in the first half of the nineteenth century.

2 French Revolutions in Science

This chapter anchors Cuvier's significance for eighteenth and early nineteenth century France. I seek to establish Cuvier's centrality in French science by examining Cuvier's rise to its centre, and by identifying competing knowledges and practices. While surveying Cuvier's rise in France I will consider two major dominant theories of the earth in eighteenth century France. Then, I will consider competing science practices of the late eighteenth and early nineteenth century, and how competing science knowledge and practice were made into narrative text. The science stories embedded in narrative texts function as *de facto* literary stories; they make sense of the world and offer new views of nature that are then incorporated into literary text and novel production. In *Rise of the Novel,* Watt demonstrates the interaction of scientific knowledge and practice, and the method of novelists in a similarly modern mode of production. This chapter looks at Cuvier's rise and his significance in relation to his counterparts at the *Muséum* in Paris, in preparing to lift up Cuvier's fundamental importance into a nuanced grand narrative of British science. Moreover, it addresses the relation between those grand science narratives, the story of science itself, and the story of the natural world around it.

Cuvier's centrality to any grand narrative of science has been advocated most vociferously in the anglophone world by Martin J. S. Rudwick in *Bursting the Limits of Time.* Rudwick opens his discussion of time and earth history by considering Sigmund Freud's claim that three great revolutions had changed "Man's Place in Nature": Copernicus, Darwin and, of course, Freud.[22] Rudwick cites Stephen Jay Gould's contention in *Time's Arrow, Time's Cycle* (1-3) that the fourth major revolution was the discovery of time, but that it does not fit into a dead white male label, or traditional diffusionist account. Rudwick qualifies Gould's "deep time" and "deep history" by pointing up "the change from regarding human history as almost coextensive with cosmic history, to treating it as just the most recent phase in a far longer and highly eventful story, almost all of it *prehuman*" (*Bursting the Limits*, 1-2). Rudwick borrows a metaphor from Cuvier for the title of his book. Cuvier aimed "to burst the limits of time" in making the prehuman world reliably knowable, just as French natural philosopher Pierre-Simon Laplace (1749-1827) had "burst the limits of space".[23] This meant placing "monuments" or "antiquities of nature" that would unlock the prehuman world on an equal footing with human history. These "monuments" or "antiquities of

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[22] Huxley, *Man's Place in Nature*. Quote is a reference to this later publication.

[23] See Rudwick, *Georges Cuvier,* 174, for a summary Cuvier's hopes to conciliate his work with that of Newton and Laplace. See Rudwick, *Georges Cuvier,* 168-9, for Cuvier's dedication of *Fossil Bones* (1812) to Laplace.

nature" were fossils, and his application of comparative anatomy to fossils created the modern discipline of palaeontology and led to a modern, descriptive geology.

The invention of earth history was the real revolution, a logical missing link between Copernicus' heliocentric universe that de-centred the earth and "the Darwinian revolution" that de-centred humans in nature. Rudwick claims that the discovery of earth history redefined human history as a phase in geological time. In order to enable this, Cuvier called for "a new species of antiquarian," one that would demystify prehuman history just as the bible and human history was being re-evaluated by textual criticism and archaeology respectively. Rudwick argues to lift Cuvier up to his rightful place in the science pantheon and in its story or grand science narrative. Cuvier's application of comparative anatomy to fossils, and his brilliant methodology exemplified by "the law of the correlation of parts," allowed him to reconstruct lost animals, species and worlds. Cuvier's work from the centre of world science produced and exported scientific authority in anatomy, zoology and geology in the long nineteenth century. In 1837, William Whewell (1794-1866) points out that evidence of "many successive acts of creation and extinction of species" (*History of the Inductive Sciences*, 625) was widely accepted, but still reconciled to scripture as "miraculous" (625) in Britain. Cuvier's mechanism for extinction was a series of geological catastrophes or "successive revolutions and various catastrophes" (625) that was termed "catastrophism" by English priest, natural philosopher and "scientist" Whewell.[24] His radical and revolutionary work on geological catastrophes was attacked and ridiculed by scientists touting competing theories, such as populariser of "uniformitarianism" Sir Charles Lyell (1797-1875). Catastrophism was labelled as reactionary in geological debate from the 1830s onward, but remained a pervasive model for earth history. In contrast, his functional anatomy and the field of palaeontology based on it was uncontested until the 1830s and remained the dominant model for anatomical thinking throughout the nineteenth century.

Cuvier found no empirical evidence to support the transmutation of species as advocated by colleagues Jean-Baptiste Lamarck (1744-1829) and Étienne Geoffroy Saint-Hilaire (1772-1844). His command of scientific legitimacy was such that he prevailed in France through three significant regime shifts—from monarchy, to republic, to empire and back. In Britain his centrality to anatomy, palaeontology, geology and biology are confirmed by the succession of actors in traditional

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[24] William Whewell can correctly be labelled as a scientist having coined the phrase in 1833. The various terms savant, naturalist and natural philosopher are correctly applied according to eighteenth-century classifications of the sciences. The term scientist becomes popular from the 1830s onwards. The term palaeontologist can be applied to Cuvier and his successors. Cuvier had become central to British science by the late 1830s, according to the widely accepted first British work in the field of history of science.

accounts of the history of science being bequeathed or donning the mantle of "the British Cuvier". Rudwick has already lifted up the significance of Cuvier in British science.[25] This study builds on that demonstrable centrality. But it also looks to answer the question why Cuvier might have been eclipsed by competing scientists, and unpopular or declared outmoded in critical work on science and British literature. Cuvier inhabits the contested spaces of science and the debate between practitioners in Britain in the nineteenth century. But before we can understand why Cuvier became fundamental to British palaeontology, and more broadly a significant source of legitimacy to British science, we must understand his career in France, the broader ideological and intellectual context, and his relationships as a science practitioner with predecessors and contemporaries.

Georges Cuvier was born in the small town of Montbéliard, a French-speaking enclave in the Duchy of Wurttemberg, in 1769. At an early age, his uncle's copy of Georges-Louis Leclerc, Comte de Buffon's (1707-1788) *Histoire naturelle* (1749) became "the great occupation of his childhood" (Outram, *Georges Cuvier*, 19). He was educated at the Stuttgart Academy (1784-1788) receiving instruction in "the study of history ancient and modern, law, public finance, technology, modern languages, medicine, mathematics, natural science, forestry and classics" (22). In the process, he learnt German and mixed with pupils from all over east and central Europe, including nobility. He was later registered to the Faculty of Administration where "chemistry, mineralogy, zoology, botany, geometry and mining" (25) were on the curriculum. Cuvier's early letters from his Normandy days to Stuttgart friend Christian Pfaff demonstrate a precocious understanding of and interest in "theories of the earth," including meditations upon German Alfred Gottlieb Werner (1749-1817) and Swiss Jean-André Deluc (1727-1817). Theories of the earth were a scientific genre attempting to explain how the earth works in one grand and unifying "system". Just as Newton's celestial mechanics was believed to have explained the universe through his laws of universal gravitation, a savant[26] tried to emulate that achievement by unveiling God's hidden design for earth. Theories of the earth dated back to Descartes and Copernicus' cosmology that de-centred the earth, making it a physical body in the new "mechanical philosophy".[27] Thomas Burnet's (1635-1715) *Telluris theoria sacra* (1680-89) was the first work to feature the title. Both comets as causal agents of change and fossils as new empirical evidence characterised this popular genre through the seventeenth and into the eighteenth century. Martin Rudwick emphasises: "it was a debate not on

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[25] Rudwick, *Bursting the Limits of Time; Georges Cuvier, Fossil Bones, and Geological Catastrophes;*

[26] Rudwick, *Georges Cuvier,* 13n.

[27] See Turner, *Mechanism and the novel*, 15-42, for an excellent exposition of mechanism in its application to British novels.

the margins of intellectual life but at its very centre" (*Bursting the Limits,* 134). He defines theories of the earth as having four main characteristics: first, they must explain all main features of the earth; second, the causes had to be natural in character; third, they had to be based on observed and knowable entities; and fourth, they should account for past, present and future—in other words, both the beginning and the end of the world (*Bursting the Limits,* 136). Theories of the earth functioned as grand unifying theories, and grand earth narratives. They intersected with existing religious schemes and worldviews in order to gain legitimacy. Their story aligned to religious fabula, in narratological terms. Theories of the earth demonstrate how scientific knowledge and practice become narrative text. They interrogate previous models of nature and provide new understandings. These new narrativised representations of nature in scientific discourses, I argue, are present in nineteenth century novels.

Buffon's *Natural History* (1749) was well known to Cuvier and widely read by scientists and laymen alike. It contained a discourse: "History and Theory of the Earth". In it Buffon used the evidence of fossil shells being widespread on land, even up mountains, and he inferred that the world was in a constant state of flux with land becoming sea and vice versa. He dismissed violent and sudden change, such as volcanoes or earthquakes, in favour of a dynamic earth, ever-changing, but in a stable state. The book had consumed Cuvier during his childhood (q.v.). His *Natural History* was among the most widely read texts of the eighteenth century and on into the nineteenth. Its story made for a compelling grand science narrative where even the constant but nondirectional flux of nature was set within a stable and eternal whole. Thirty years later in *Les époques de la nature* (1778) Buffon changed his system for terrestrial change based on water—what we might call neptunist—for one based on heat, or plutonist.[28] Evidence from mining had convinced him of this, in addition to reports of remains of tropical mammals and fossils in northern climates, suggesting a hotter climate in the past. Buffon proposed a slowly cooling earth; a model which both Burnet in *Sacred Theory of the Earth* and Gottfried Wilhelm Leibniz (1646-1716) in the posthumously published *Protogea* (1749) had used. But Buffon's cooling earth theory achieved international publication and renown. His three classes of evidence—facts, monuments and traditions—inform Cuvier's work. "Facts" were observable features of the present, "monuments" natural vestiges or remains of the past, and "traditions" were human textual evidence. The cooling earth theory of *Nature's Epochs* introduced a directional universe quite unlike the previous of *Natural History.* Buffon envisioned seven successive epochs of a world destined to a frozen end. The earth was no

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[28] See Chapter 5 for an explanation of neptunism and plutonism in context; alternatively, Rudwick, *Bursting the Limits,* 119n.

longer eternal, but its age was far above estimates previously given at over 70,000 years. Buffon followed a well established tendency in equating his seven epochs to the seven days of creation. His system certainly did not need God as an ultimate cause; however, he may well have held some form of deist belief in a supreme being which does not intervene in the universe. Buffon's theory of the earth became a default model for directional narratives of the natural world. In Buffon, nature moves from order to disorder. Buffon's eternalist *Natural History* and directionalist *Nature's Epoch's* stand as two powerful stories of the earth.

Buffon's cooling earth theory was very different to another popular theory at about the same time that we know Cuvier had read and commented on. Jean-André Deluc presented a theory of the earth that was integral to Christian cosmology. Deluc had moved to England in 1773 and become a fellow of the Royal Society and Queen Charlotte's mentor. Deluc was a fieldworker in contrast to Buffon's theoretical approach. *Lettres sur les montagnes* (1778) and *Lettres physique et morales* (1779), inspired by fossil evidence, divided the world into two distinct and discrete periods, the ancient and modern worlds. The two worlds were separated by a "great Revolution". The ancient world was vast in duration and prehuman; the modern world was equivalent to that of human records. In effect, Deluc's system, without positing causes for the sudden change of the great revolution, shoehorned nature into a Christian scheme. But his binary division of worlds, his great catastrophe, and his resistance to Buffon's theoretical schemes are present in Cuvier. Buffon and Deluc constitute the two major French theories of the earth competing for scientific authority in eighteenth century France.

Cuvier escaped the terrors of the French Revolution working as a private tutor for a Protestant nobleman in Caen, Normandy, between 1788 and 1795 when both *Letters Physical and Moral* and *Nature's Epochs* were published. However, Revolutionary France provided him new opportunities for advancement. Outram (*Georges Cuvier*, 19) points out Cuvier knew "he depended upon radical change in the nature of society and the distribution of its resources" in order to advance in his vocation. Post-Terror the old networks of patronage were swept away and new regimes were committed to natural history and its teaching in schools. Outram (*Georges Cuvier*, 52) stresses that savants were "uprooted and displaced," unable to rely on clear systems of patronage and in a context where science, the role of the scientist and what was expected of them by state, peers and the public were all changeable and uncertain. The Directory (1795-1799) established the *Institut de France* in 1795 to replace the old Royal Academy of Sciences, transforming the Royal Botanical Gardens and Royal Museum into the *Museum national d'histoire naturelle*. Cuvier came to Paris in 1795 as understudy to Mertrud, professor of Animal Anatomy, finding himself at the

centre of world science at the age of twenty-six. Montbéliard had been annexed in 1793, Cuvier was now a French citizen. His inaugural lecture course on comparative anatomy, standing in for his professor, provides evidence of his early conception of organisms as functionally integrated "animal machines". Rudwick (*Bursting the Limits,* 355) points out this was not original to Cuvier. But public interest in science was great and Cuvier's lectures were to constitute a "high point of a spectrum of rational but spectacular entertainment".[29]

Through the Directory Era Cuvier's papers progressed from marine invertebrates to vertebrates leading him finally to concentrate on mammals, and in particular fossil bones. Fossils had featured in Buffon's theories of the earth as expounded in his *Natural History* and *Nature's Epochs* (q.v.). Cuvier made fossils key to any understanding of theories of the earth or "geology," after Deluc's neologism in *Letters on Mountains* (1778). But his "wide interests" inevitably brought about conflict with collaborator, Geoffroy, and colleague, Lamarck, in particular. (*Bursting the Limits,* 355) The Revolutionary Wars and France's expansion had brought access to new collections at the *Muséum. Species of Elephants* (1796) was presented at the *Institut,* published in *Magazine encyclopédique*, and later published in full in 1799 in the *Institut's Mémoires*. This groundbreaking paper proved that African, Indian and fossil elephants were from distinct species. This demonstrated that the fossil elephants were from an extinct species. Moreover, the paper dismissed the fashionable notion of transformation while upholding the fixity of species. In addition, it undermined Buffon's cooling earth theory while announcing the importance of comparative anatomy as a key to unlocking theories of the earth. Rudwick stresses that Cuvier's paper not only presented a "tacit challenge" to both Barthélemy Faujas de Saint-Fond (1741-1819), professor of geology at the *Muséum*, and to Cuvier's patron and stalwart of the Old Regime, Buffon (*Bursting the Limits,* 363). In short, Cuvier's paper provided new and subversive scientific knowledge and narrative. Both dominant Buffonian accounts and emergent Lamarckian ones were challenged.

Cuvier was appointed secretary in 1802 and then permanent secretary to the *Institut* in 1803. Having set out a basis for comparative anatomy in his textbook *Tableau élémentaire* (1788) he proceeded to establish his discipline. Cuvier was at the heart of science at the *Institut* and exerted control and dominance over his scientific field and science in general. His four-volume *Lessons in Comparative Anatomy* (1800-1805) explicated the "law of the correlation of parts".[30] Cuvier examined the various anatomical organs, movement, sensory, digestive etc, and described a

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[29] Outram, *Georges Cuvier*, 51

[30] See Dawson, "Literary Megatheriums and Loose Baggy Monsters: Paleontology and the Victorian Novel"; "Paleontology in Parts: Richard Owen, William John Broderip, and the Serialization of Science in Early Victorian Britain", for the development of Cuvier's palaeontology as a model for serialized fiction.

functional symmetry in relationship of parts to whole. The law of correlation is Cuvier's theoretical and methodological contribution to various fields. It provides a new understanding of theories of the earth or the nascent "geology" at the same time in countering un-empirical and speculative systems or grand unified theories of the earth, most of which attempted to reconcile scripture and empirical data in pre-revolutionary France as well as in Britain. It established and consolidated the new field of comparative anatomy, while giving rise to a new discipline centred around fossils, "palaeontology".[31]

Cuvier had established himself at the very heart of science at the *Institut* in Paris. He had successfully begun to distance himself from previous theoreticians and consolidated his move from periphery to centre. He had weathered regime change successfully, and, while speaking out against fashionable post-Revolution ideas of transformation, had proved himself invariably adaptable. Cuvier was now deciding what was and what was not proper science. Moreover, he had gained a reputation for near-heroic powers in recreating lost species and worlds. Cuvier's assertion of his position and control of science's contested space in his newfound authority brought him into debate and conflict with friends, colleagues and adversaries. This study will focus on two of the most significant professional rivalries, with Lamarck and Geoffroy Saint-Hilaire.

Lamarck was born in Picardy in northern France. He studied botany and gained a position at the French Academy of Sciences as Royal Botanist in 1781 thanks to the patronage of Buffon. Lamarck was introduced to Buffon's *Nature's Epochs* (1780) where his mentor challenged Linnaean classification as a description of a static universe ignoring the historical development of life on earth. In spite of Buffon's patronage, Lamarck's first papers rejected Buffon's theoretical approach in *Nature's Epochs,* supporting speciation from complex to simple, the direct opposite of his mentor (*Bursting the Limits,* 389). His annual course on invertebrate zoology (1794-1820) contained his first public statement that species were subject to change in 1800 (Jordanova, 6). He controversially rejected, however, the "new chemistry" of Lavoisier and Priestley based on elements and compounds.

In *Hydrogéologie* (1802) Lamarck tested his emergent theory of transmutation based on meteorology. Everything exhibited some form of "flow" in a steady-state uniformitarian "geology" with climate change as a mechanism. Following his mentor, Buffon, he questioned Linnaean taxa as constructs, and posited the idea of the inheritance of acquired characteristics. Lamarck's nature was materialist, atheist and "heralded radical extremism, if not revolution" (Desmond, *Grant: A*

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[31] Coined in 1822 by Henri Marie Ducrotay de Blanville, editor of *Journal de Physique*.

Pre-Darwin Transmutationist, 214). Cuvier had worked with colleague Geoffroy on speciation by degeneration from a common ancestor. Geoffroy travelled to Egypt on Napoleon's expedition in 1799. Outram marks that this was the beginning of a major deterioration in their friendship (*Georges Cuvier*, 61-64). Geoffroy returned in 1802 with mummified animals that Cuvier claimed proved the fixity of species (*Bursting the Limits,* 394-396). As a direct result of this, Lamarck was forced to sign the *Muséum's* 1802 report, a position he later retracted claiming that 3000 years was not enough time to show evidence of transmutation. It must have been a particularly souring experience for Lamarck, belittled by his junior Cuvier and forced into a public show of his defeat. Rudwick shows how Lamarck publicly abandoned any belief in the fixity of species in 1802, citing *Hydrogéologie* and *Recherches sur l'organisation des corps vivans* (1802) (*Bursting the Limits,* 398). In *Hydrogéologie,* Lamarck's nature was in constant creation and speciation occurred from complex polygenetic forms to simple. Cuvier's work with Geoffroy on speciation through degeneration from a single monogenetic ancestor is conversely opposed to Lamarck's nature of spontaneous generation without shared ancestral heritage.

Philosophie zoologique (1809) is the final exposition of Lamarck's theory of transmutation or transformism. In it, Lamarckism allows change from simple to more complex beings through use and disuse, giving organisms agency in their progression. Darwin's later theory, by contrast, allowed for development to occur at the moment of conception, not during an organism's lifetime. Lamarck's spontaneous generation means that organisms are constantly created and transforming into more complex creatures in a form of specialisation. This does not necessarily mean that the whole process of "evolution" is a teleological journey from start to finish perfecting organisms; but rather that as organisms disappear others replace them in a constant flow. Rather than being based on a natural world of taxa in a 'chain of being' or pyramid, Lamarck saw an organic unity open to deistic interpretations. Lamarck, however, did not use terms such as "soul" or "vital life" characteristic of deist writings (Jordonova, *Lamarck,* 44). Lamarckian science narrative offers a new deist approach in a directional universe. However, directionalism in Lamarck does not offer teleology.

Cuvier and Lamarck were competitors as professional science practitioners in the world's foremost centre for natural history and the natural sciences. Cuvier had publicly rebuffed Lamarck's patron and mentor Buffon in his very first paper. His junior by some way, Cuvier had leapfrogged Lamarck into a position of power and influence exercising hegemony over what was considered "proper science" in the Directory Era, and then on into the First French Empire and the Bourbon Restoration. After his public climbdown on evidence of transformation from the mummified

Egyptian animals, Cuvier publicly ridiculed Lamarck in a lecture at the *Athénée de Paris* in 1805, and then in his "eulogy," dismissing his zoology along with his outmoded chemistry (Buckhardt, 195-196). Lamarck's fortunes tumbled, his written style, his reliance on outmoded chemistry and, perhaps most of all, his theoretical association with radical, atheist politics all played a part. Lamarck's lack of narrative skill may be a significant component in the relative success of his science stories in relation to Cuvier. Cuvier's mastery of the discourse form gave him a distinct advantage in communicating his scientific knowledge and practice. As the First French Empire rose and the Napoleonic Wars raged, Cuvier seemed the better exponent of Lamarckian transformism in adapting his work and utterances to secure his professional future.

Cuvier's *Geographie minéralogique* (1808),[32] co-authored with Alexandre Brongniart, gained immediate international success due to its potential commercial application in mining (*Bursting the Limits,* 498). This geological study demonstrated climate change in interchanging marine and freshwater environments present in rock strata. The pre-1789 concept of circular revolutions inherited from the ancient world gained a post-Revolution meaning in violent upheaval or sudden catastrophes.[33] But what did this shift mean for both scientific and religious? The theological connotations of Cuvier's work were largely insignificant in a France where the schism between state and church had been healed by the Concordat of 1801. (Rudwick, *Bursting the Limits*, 449) In spite of the fact that Roman Catholicism was not re-established as state religion until the restoration in 1815. Cuvier's sudden catastrophes and influxes of water in the *Geology of the Paris Basin* could be analogous to the Mosaic flood. Without question, *Paris Basin* was an international success as a publication, being useful as it was to the mining industry. This period represents an apex in terms of publication for Cuvier. His *Historical Report* (1810) summarised the development of the natural sciences since 1789, again underscoring his dominance and centrality to world science. In the same year *Paris Basin* was his first publication translated into English and widely distributed. Then in the 1812 *Preliminary Discourse* and *Researches on Fossil Quadrupeds* Cuvier collected all his fossil research. Cuvier's research focus then shifted on to work within anatomy. He published *The Animal Kingdom* in 1817 replacing the Linnaean system of classification in animals with his system of four *embranchements* or phyla. The *radiata* were creatures based on radial symmetry such as sea urchins or jellyfish. The second *embranchement, mollusca,* consisted of shelled creatures. Insects and worms with segmented bodies made up the fourth *embranchement,*

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[32] English trans. *Geology of the Paris Basin.*

[33] Rudwick, *Georges Cuvier, 21n.*

articulata. And finally *vertebrata* or creatures with backbones: mammals, birds, reptiles, amphibians and fish. This extended the division of vertebrates and invertebrates, but has since been expanded from four to thirty-five, with subdivisions of some phyla and kingdoms and domains having been added above. *The Animal Kingdom* superseded the traditional model of the chain of being with lower forms at its base narrowing up to higher forms, and humans, at its apex. It provided a robust structure admitting no transitional forms between its formal divisions.

Cuvier's self-organising and functionally integrated comparative anatomy as expounded in *The Animal Kingdom* was challenged by colleague and erstwhile collaborator Geoffroy. Outram points out that Cuvier's position as Permanent Secretary of the Academy of Sciences allowed him to shape "the language of official science and its mythology" (*Georges Cuvier*, 109). Geoffroy responded by politicising the language of science and debate turned to conflict. Their earlier collaboration in the 1790s had failed to unify their two conflicting positions. Geoffroy privileged form over function; Cuvier saw no possible movement between his four fixed *embranchements.* In *Philosophie anatomique* (1818-1822) Geoffroy proposed a system of classification he called the unity of plan, or unity of organic composition. Influenced by German *naturphilosophie,* his philosophical or transcendental anatomy looked for 'analogies', since confusingly clarified as homologies by British anatomist, Richard Owen. Geoffroy's 'analogies' sought structural similarities between different animals, in contradistinction to Cuvier's functionally integrated beings in rigid phyla. Geoffroy privileged form, in homologous structures between different animals, over Cuvier's conditions of existence or its functional mode of life; it was an inversion of Cuvierite anatomy. Geoffroyism implied the possibility of transitional forms and movement between Cuvierite divisions in the animal kingdom: in short, transformism.

Geoffroy's counter-system was undoubtedly a challenge to the dominant Cuvier. By the 1820s extinction was widely agreed on by the international science community keeping transformism in check. Geoffroy, professor of vertebrate zoology, published a paper challenging Cuvierite anatomy, *Organisation des gavials* (1825). He used the 1823 Caen fossil crocodile head, dubbing it *teleosaurus*, to imply a possible transitional link between fossil and living forms. Geoffroy used monstrosities as examples of change in an actualistic argument, where an observable present explains the past. He rejected Lamarck's model of life's constant change from simple to complex seeking perfection, instead turning to Lamarck's other driver, the environment. Geoffroy used the accepted geological model of revolutions as a potential cause of change. However, his understanding of physical geology undermined his argumentation. Nonetheless, Geoffroy was challenging Cuvierite functional anatomy in a geological context. The paper presents the possibility

of vertebrates as variations on a single, common anatomical theme. A second article, *Structure organique et de parenté* (1828) continued Geoffroy's arguments. As a preface to the debate to follow, Geoffroy's challenge of Cuvier in the field of palaeontology and geology demonstrates remarkable adventure on his part.[34] But direct engagement did not break out until 1830 when Geoffroy baited Cuvier in a review of a paper on the anatomical organisation of molluscs at the reinstituted *Académie*. Cuvier countered by belittling Geoffroy's principle of unity, implying that it could only identify vague analogies (homologies) between different species. In response, Geoffroy initiated a philosophical debate between form and function. He believed his structuralist morphology could find similarities within apparent dissimilarities.

Desmond has noted on numerous occasions the radical, if not downright revolutionary nature of French science from the perspective of established British elites.[35] Once Cuvier had carved out his space to practice science so effectively in Paris at the *Institut*, he played the "pragmatician" and consolidated his position whenever possible—what else should an immigrant do? His own Doctrine of Revolutions caused its own repercussions and was of interest to political reformist and activists in Britain (Desmond, *Artisan Resistance 1818-1848*). But he also apparently performed an active role in keeping that same materialist radicalism at check in France. However, it was primarily in Britain, not France, that revolutionary science had most impact on the establishment and science community, as the need to police volatile continental materialism commanded attention in multiple cultural spaces.

Summary

While placing Cuvier in his context I have, at the same time, been aware of the narrative elements of his work. This voicing of an extended narrative of science from France to England and British fiction can be seen from within a narrative division of fabula, story and text. There are accepted and dominant grand narratives of science and of natural history present, at the same time as there are different strands telling different stories in different times and different places. There must be structural parallels, if science is seen as a cultural production just as literature, between how we receive and perceive Cuvier and, similarly, our British fiction. These narratives require that we pay attention to language and aesthetic detail in, for example, Cuvier's texts and utterances; I combine this attention with the rich historical approach that situates meaning at periphery not centre. In other

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[34] Rudwick, *World's before Adam,* 237-242.

[35] Desmond, "Artisan Resistance and Evolution in Britain, 1819-1848"; *The Politics of Evolution : Morphology, Medicine, and Reform in Radical London*.

words, the science and cultural productions of science can be analysed in a similar way to literary productions.

It follows, therefore, that the popular science genre called theories of the earth, as traced from the Renaissance on, are important narratives in that the reordering of the base material or fabula — whether correct or incorrect data — is analogous with story in fiction. Cuvier set himself against so-called theories of the earth because of their formal and intertextual use and incorporation of religious myth and tradition. However, the potency of an accepted myth of creation, of nature, of earth history should not be underestimated. Structural similarities such as days of creation and eras or ages of the earth, or dating systems, or origin myths were functional intertextual techniques to claim legitimacy and authority for new science stories. At the same time, both Watt (*Rise of the Novel*) and McKeon (*Generic Transformation and Social Change: Rethinking the Rise of the Novel*) have emphasised the novel's alignment with scientific empiricism in approach.

It can be argued that science and literary genres converge in the eighteenth and nineteenth centuries. Travel writing and journals (fieldwork) are all based on observation and a journalistic pursuit of truth. The emergence of realism and the novel emphasise the "primacy of individual experience", where observation by the individual and truthful reporting allows for both a highly subjective and simultaneously objective view of reality. These are all interrelated developments at a time when the "two cultures" division did not exist in broader perception. Romance and traditional stories based on existing plots, such as Shelley's *The Last Man* for example, blended with particularised and specific realistic details of everyday life. Moreover, speculative fiction and the novel appropriated science as subject matter and fabula in weaving science fiction stories. So these similarities are both structural in form and genre, as well as thematic and in subject matter as science becomes the subject of literature, as well as influencing its technique, or how literature is done. Literature begins to incorporate approaches to reality and truth through observation of everyday detail, instead of a fascination with the highborn and their familial internecine strife. Science becomes literature, and, reflexively, literature becomes a medium for science stories. The novel appropriates scientific method and the worldview of science. We also, simultaneously, trace the movement of grand science narratives into the narratives of British novels and fiction. They are part of the very specific context of story in our respective novels, here ordered by the temporal context of story, not of the context of authorial intention and invention—a context I have associated with the fabula.

If evolution is a suitable analogue for literary form and structure, or for its thematic content and subject matter, then, however limited this may be in its use, it follows that other possible

structures and templates abound. Theories of the earth tend to push grand unifying theories that, on evidence, intertextually relate to dominant religious beliefs, or at the very least incorporate them to gain legitimacy. We can consider Buffon's historical directionalism as introduced in *Nature's Epoch's* as loosely analogous to development in the novel as genre and form. At the same time, we might like to consider Cuvier's "law of the correlation of parts," and Lamarckian transformism as similarly competing stories within science narrative. It is not enough to dismiss Darwinian evolution, which changes in time and space, without introducing other narrative drivers in science. Beer (*Darwin's Plots*) points out that Darwinian evolution signposts the death of the individual as a placeholder for meaning or purpose. How then can that be reconciled with the centrality of the individual in the novel form and genre?

Cuvier's doctrine of revolutions uses the mechanism of catastrophe to interrupt a perfect and harmonious natural world described by the law of the correlation of parts. The law of the correlation of parts is a functional basis for anatomy in the nineteenth century, and an anatomical understanding of human nature. So this study addresses broad issues of science as narrative, and similarities in science and literary writings. It begins to address the multiplicity of broad paradigmatic understandings of the natural world that both science and art engage, broaching the idea that the novel moves toward science writing in terms of realism, perspective, and its continuum of individuality and particularity contra universality. Is science writing an unvoiced part of the development of the novel genre? I suggest it is a component in this development. Empiricism and Baconian inductive reasoning challenged speculative theoretical approaches focusing on the observable natural world. Indeed, realism as a movement in literature and art attempted to disguise the "storyfication" of fabula by imitating of factual genres such as journals, diaries, confessions, epistolaries etc.

This chapter has contextualised Cuvier in the contested space of French science. It charts Cuvier's move from periphery to the centre of French scientific legitimacy. It provides a broad historical overview of the community of competing science to which he belonged. The main figures of that community were Buffon, Deluc, Lamarck and Geoffroy. Buffon's cooling earth theory and Deluc's binary division of ancient and modern world are contrasted with Cuvier's law of correlation and the Doctrine of Revolutions. Then the transformism of Lamarck and the Geoffroyan unity of plan within the field of anatomy provide French context. This community of practice can be described as pre-Darwinian evolutionary models. However, this shifts focus back to Darwin in the grand narrative. We can see the importance of narrative in science that may have secured lasting readership for Buffon and Cuvier. Moreover, both scientific method and science narrative texts have

a significant interaction with novels and their development through the first half of the nineteenth century. I hope to develop these arguments in the following two chapters which close read Cuvier's papers as narrative texts, and pay particular attention to his masterpiece of narrative scientific prose, the *Preliminary Discourse.*

3 Cuvier's Early Papers

In chapter two I argued for the centrality of Cuvier's scientific knowledge and practice in his field in France. Moreover, Cuvier achieved both political power within central institutions of science and ideological dominance from within those institutions. Cuvier's discourses were significant as both artefact, i.e. physical text, and as dominant cultural narrative. I have begun to propose a connection between Cuvier's ideological success and his narrative strategies. Chapter three will examine the intersection of Cuvier's and competing "science stories" in greater detail.It will identify key ideological debate and ask how they relate to any overarching historical grand narrative. I will also close read the language and literary techniques of the texts in order to both incorporate a formal approach and pay attention to language as medium. Finally, I will investigate connections between science, scientific discourse and the novel. The novel seeks new understandings and representations of nature in its quest for constant renewal and originality. This study identifies "science stories" in British novels, while also exploring the ways in which scientific practice relates to literary approach.

The previous chapter provided a broad social context for Cuvier's career in France through three forms of regime: republic, empire and monarchy. Greater detail can be found in purely historical works on Cuvier's life and that of his contemporaries.[36] The rather brief review offered here serves to centre the study in historical context and in the overarching narrative of the politics of science and nature. Cuvier's career was one of constant debate and conflict. The review presented in the previous chapter accounts only for but a few of the main ideological players and their respective interactions. Rudwick's updated translations have been used rather than rendering the original French.[37] The original sources have been given in the bibliography, but for ease of reference and consistent translation the single collected source has been used. Generally, where French titles may be given at first, English translations have then been followed after. Although this study clearly encompasses many cultures and languages, limiting it to English where possible is intended purely functionally to aid reading. It is hoped that the appraisal of Cuvier's textual production will allow increased insight into the historical developments of the breadth of disciplines to which he contributed, and into his own literary production in his journey from periphery into the very centre of the scientific world .

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[36] Outram, *Georges Cuvier;* Coleman, *Georges Cuvier;* Rudwick, *Georges Cuvier, Bursting the Limits*.

[37] Rudwick, *Georges Cuvier, fossil bones and geological catastrophes.*

As early as 1792 Cuvier writes to fellow student at Stuttgart and friend Christian Pfaff explaining Deluc and his theories based on a series of major catastrophes outlined in his *Physical and moral letters* (1779).

> Although you have already mentioned Deluc and his major catastrophes several times, I think you only know of the earlier system he expounded in his Physical and moral letters.[38]

Cuvier goes on to outline Deluc's "system" he has read in letters to Mr de Lamethérie.[39] Deluc divides earth history into six major periods, just as Buffon had done in *Nature's Epochs* (1778). This kind of overlaying of earth history in theories of the earth, for which Deluc himself had proposed the new term "geology"[40], onto Biblical conventions i.e. the six-day creation of Genesis, was a strategy Cuvier would most vigorously discard in his method and work. Deluc's theory of the earth or "geology" provides six major periods. The first period produces the "water fluid" or "liquid" from which the earth is formed. In the second period granite and similar base rocks are precipitated; in the third the "primordial beds" are formed, a solid crust around the earth, but with "cavities" under, into which the crust breaks forming primordial mountains. The fourth period sees gases forming under the surface and again breaking the crust and throwing up fragments. The result of this in the fifth period is a new series of "revolutions" with caverns forming under the earth (still covered in liquid) and various collapses forming limestone, sandstone, coal and chalk beds. During all this period, Cuvier notes, vegetation has grown and there are marine animals, hence the presence of shells etc in the various rock formations.[41] Deluc's gradual and catastrophic development of the earth over a six-period history— assuming an age of the earth well in excess of that of traditional Christian datings[42]—was one of a series of theories of the earth being debated in France about which Cuvier could write home to his friends in Germany. In Deluc "the world had been destroyed several times before the creation of man", just as Byron put it in his prefatory note to *Cain: A Mystery.* This succession of major catastrophes is inherited by Cuvier from existing work; moreover, Cuvier incorporated Deluc's binary division of ancient and modern world.

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[38] In Rudwick, *Georges Cuvier, Fossil Bones and Geological Catastrophes*, 10. Extract translated from Cuvier to Pfaff, 11 March 1792, printed in Cuvier, *Briefen an Pfaff* (1845), 257- 60.

[39] Deluc, "Lettres a M. de to Metherie" (1790-93), published in *Observations sur la physique*. Jean-Claude de Lametherie (or de la Metherie, or Delametherie; 1743-1817) was the editor of the periodical in Paris.

[40] Deluc, *Lettres sur les montagnes* (1778). See Rudwick, *Georges Cuvier, fossil bones and geological catastrophes,* 4-6, for greater detail on Deluc and Cuvier.

[41] See Rudwick, *Georges Cuvier, Fossil Bones and Geological Catastrophes*, 10-12, for Cuvier's letter to Pfaff in translation. My summary is necessarily brief as the actual stratigraphy (or geognosy as it would be termed at this time) is not my main point in hand.

[42] Ussher's dating is perhaps the most famous at 23 October 4004 B.C.

Species of Elephants, 1796

The abstract of Cuvier's first paper, *Espèces des éléphants* (1796), is striking in its use of the Republican calendar (1792-1806). I have already posited Outram's analysis of the "radical change in the nature of society" (*Georges Cuvier*, 19) that precipitated Cuvier's speedy rise. The fact that time, the calendar, could simply be restarted is a remarkable context for Cuvier's work. Cuvier's first papers presented to the *Institut National*[43] immediately questioned accepted understandings of nature. In them he demonstrated the power of comparative anatomy as an ancillary tool to Deluc's "geology". His analysis of the bones of African, Indian and fossil elephants in *Species of Elephants* (1796) identified them as separate species, as different as "the horse from the ass or the goat from the sheep."[44] This had several effects: firstly, he publicly declared the power of comparative anatomy as a tool in geology or theories of the earth.[45] Considering the case of the elephants, Cuvier writes:

> It is to anatomy alone that zoology owes this interesting discovery, which a consideration of the exterior of these animals would only have been able to render imperfectly. But there is [also] a science that does not appear at first sight to have such close affinities with anatomy; one that is concerned with the structure of the earth, that collects the monuments of the physical history of the globe, and tries with a bold hand to sketch a picture of the revolutions it has undergone: in a word, it is only with the help of anatomy that geology can establish in a sure manner several of the facts that serve as its foundations.(Rudwick, *Georges Cuvier*, 19-20)

In his inaugural paper he was able to determine that these were separate species, whereas natural historians had always dealt with them as one. The presence of fossil elephants in Siberia North America, Europe etc far away from their modern-day habitats had given rise to various theories. First, that they had been swept there by great masses of water, in some form of catastrophe, or perhaps marched there as Hannibal had done in classical accounts. Cuvier's paper proved these theories unnecessary. Second, Buffon's cooling earth hypothesis in *Nature's Epochs* (1778) presented a "science story" of migration. Cuvier noted Buffon posited that the earth had "emerged burning from the mass of the sun, and had started to cool from the poles." (Rudwick, *Georges*

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[43] Cuvier had a junior position as understudy at the Muséum d'Histoire Naturelle. The Institut National had replaced the old Académie Royale des Sciences. It was as a part of this shake-up that Cuvier had been able to be positioned there. His first papers were published in summary in the Magasin encyclopédique, later in full in the Institut's Mémoires.

[44] Rudwick, *Georges Cuvier, Fossil Bones and Geological Catastrophes*, 19. Translated from Cuvier, "Espèces des éléphans" (Species of elephants, 1796).

[45] The term geology was still a neologism and synonymous with the genre "theories of the earth" to which Cuvier clearly does not belong. It could be argued that Cuvier himself marks the transition, with geology not being synonymous with "theories" once he had set out his research agenda. Cuvier often mocks and chides self-styled geologists, and himself uses theory of the earth in later texts presumably because the public would recognise this. His *Researches on Fossil Quadrupeds* (1812) was published in England as Essay on the Theory of the Earth (1813). This was an editing of his own statement that his research was "an essay on a small part of the theory of the earth".

Cuvier, 22) The cooling earth had led species to migrate over its surface seeking new and habitable climes. But Cuvier's work again made this hypothesis unnecessary; these were not the same species.

In fact, this led Cuvier to suggest an even more remarkable (if, again, not wholly original) possibility: "What has become of these two enormous animals of which one no longer finds any [living] traces, and so many others of which the remains are found everywhere on earth and of which perhaps none still exist? […] Why, lastly, does one find no petrified human bone?" (Rudwick, *Georges Cuvier*, 23-24) Cuvier implies the possibility of extinction and, at the same time, voices another important issue: the absence of human bones. Altogether this pointed to an ancient world (*ancient monde*):

> All these facts, consistent among themselves, and not opposed by any report, seem to me to prove the existence of a world previous to ours, destroyed by some kind of catastrophe. But what was this primitive earth? What was this nature that was not subject to man's dominion? And what revolution was able to wipe it out, to the point of leaving no trace of it except some half-decomposed bones? (Rudwick, *Georges Cuvier*, 24)

Cuvier's use of a "world previous to ours" invokes the catastrophic progression of Deluc's theory of the earth, of Deluc's major catastrophes, and sits well with a binary division of earth history into modern and ancient worlds. The reader is confronted by lost species, "beings whose place has been filled by those that exist today, which will perhaps one day find themselves likewise destroyed and replaced by others" (*Species of Elephants*, 21). The implication is that if this previous and ancient world had been destroyed, and that there were no traces of human bones, then, first, it was a *prehuman* world, and, second, that our world too might one day be destroyed in a future calamity. This early substantive implication in Cuvier, that there could be former and future worlds punctuated by catastrophic changes—if not original—resonates with Bernard Le Bovier de Fontenelle's *Conversations on the Plurality of Worlds* (1686). Cuvier dedicated *Researches on Fossil Quadrupeds* (1812) to Pierre-Simon Laplace (1749-1827), author of *Mécanique céleste* (1799-1825). His desire to place his own science, comparative anatomy, on an equal footing with astronomy he made explicit on many occasions, using the "burst the limits of time" trope analogous to Laplace's bursting the limits of space, i.e. that geology, powered by Cuvier's functional comparative anatomy, could do for the history of the earth what astronomy had done for the universe. Cuvier tantalisingly hints at a similar plurality of worlds in earth history, former and future.

Cuvier employs and redefines existing uses of language as his ideas shift. We have taken up Buffon's proofs of "facts", "monuments" and "traditions". Rudwick (*Georges Cuvier*, 46) suggests

that Cuvier takes this language to new levels. Certainly, "monuments" in all its forms is an important image in Cuvier. Another significant distinction is that between "revolutions" and "catastrophes", the former being slow and circular processes, the latter signifying "sudden and violent change". Deluc's "major catastrophes" were part of the creation of the earth, whereas Cuvier begins to suggest that "catastrophes" may belong to a time far closer to our own. By 1798 Cuvier had already distanced himself scientifically and rhetorically from illustrious predecessors, such as Buffon, and counterparts, such as Deluc. His power and self-confidence were growing, enabling him to further outline his goals and research agenda with fossils and comparative anatomy applied to geology at its core. He had named the *megatherium*, the so-called "Paraguay animal", linking his name irrevocably to the first "animals of the ancient world," that "world previous to ours" (Rudwick, *Georges Cuvier*, 32). He had shifted the meaning of catastrophe away from the slower revolutions of the globe and introduced a new large-scale environmental force, both local and general. Where Buffon and Deluc had produced schemes accommodating biblical six or seven-day structures, Cuvier simply did not need them. The dismissal of Buffon's cooling earth theory in order to explain fossil bones of large quadrupeds in different climate zones, "alien to the climate in which they are found", (Rudwick, *Georges Cuvier*, 33) demonstrated the power of Cuvier's method. This method, based on the twin prongs of "the law of the correlation of parts" and "conditions of existence", gave Cuvier a powerful box of tools that did not need to incorporate the persisting structures of the bible; a method that in fact did not need any external causes at all.

Cuvier explains his idea of *charpente,* the relationship of bones in a framework, "that—up to a point—one can infer the whole from any one of them, and vice versa". This would allow him to reassemble "the bones of giants" (Rudwick, *Georges Cuvier*, 35-36) and reconstruct lost species from lost worlds; a precursor to his exposition of the "law of the correlation of parts" that would underpin the functional anatomy of the nineteenth century. To the uninitiated, this may well have seemed an impossible knowledge and feat for humans, akin to sorcery or the dark arts; its magic no more outlandish than the giant's bones these "monuments" were previously claimed to be. In the following passage on the so-called "Paris animal" from the *Memoires*, he verbally reconstructs the ruminant from bone to muscle to flesh:

> The bones being well known, it would not be impossible to determine the forms of the muscles that were attached to them; for these forms necessarily depend on those of the bones and their ridges. The flesh being once reconstructed, it would be straightforward to draw them covered by skin, and one would thus have an image not only of the skeleton that still exists but of the entire animal as it existed in the past. One could even, with a little more boldness, guess some of its habits; for the habits of any kind of animal depend on its organisation, and if one knows the former one can deduce the latter. (Rudwick, *Georges Cuvier*, 40)

The audience here is strictly scientific at the *National Institut*, but nonetheless the idea of physical reassembly in all its gory detail can be sensed. This kind of verbal reconstruction pre-empts the pictorial and physical recreations to follow—the Peale Mammoth being Cuvier's framework or *charpente* physically realised.[46] Cuvier's deductive method could help establish what he termed "conditions of existence", an Aristotelian concept of ancient science. He extrapolates from tooth, to digestive system, to skeleton, to locomotive organs and sense organs, to prey. From habit to habitat, with lessening degrees of certainty, lost species could be brought back to life: "For these relations are the necessary conditions of existence of the animal; if things were not so, it would not be able to subsist." (Rudwick, *Georges Cuvier*, 36) The Cuvier of 1800 is verbally daring, seeking to push the boundaries of science through empirical work, through dissection, through the tools of comparative anatomy. The synecdochal logic of the part and the whole allows his rhetoric—even at the *Institut*—to spiral out towards grand narratives and the spectacle of earth history:

> And indeed, how can one fail to pardon some leaps of imagination, when warmed by so great a spectacle? How can one repress such a natural desire to give an account of causes that have been able to produce such terrible effects: to raise mountains, to shift seas, to destroy whole species, in a word to change the face of the globe and the nature of the beings that inhabit it? (Rudwick, *Georges Cuvier*, 40)

Species of Quadrupeds (1801)

In 1800 Cuvier has an extract from a paper, *Species of Quadrupeds* (1801), presented to the *Institut*. It represents a young naturalist at the height of his powers and confidence, making an appeal for a concerted effort to help him in reaching his goals. The paper is "addressed to savants and amateurs of the sciences" and contains some of Cuvier's most hitherto impassioned prose. The matter-of-fact tone of previous publications and papers is dropped revealing a glimpse of the mature Cuvier, publsihed by Jameson, in *Essay on the Theory of the Earth* (1813). Cuvier starts *Species of Quadrupeds* (1801) with a new degree of declarative certainty:

> EVERYONE NOW KNOWS that the globe we live on displays almost everywhere the indisputable traces of vast revolutions: the varied products of living nature that embellish its surface are just covering debris that bears witness to the destruction of an earlier nature. (Rudwick, *Georges Cuvier*, 45)

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[46] The English-speaking audience may have first learnt of catastrophic extinction through Rembrandt Peale's *Historical Disquisition on the Mammoth* (1803). The mammoth represents the first performative reconstruction of former worlds. The mammoth comes to signify Cuvier's theory of catastrophic extinction and features heavily in Byron (*Cain*, *Heaven and Earth*, *Don Juan* etc). However, its absence in further literary fiction or romance-fiction is notable. One might imagine the Peale Mammoth alongside Frankenstein as respective giant and beast of the antediluvian earth. Irish adventurer Thomas Ashe wrote in *Memoirs of Mammoth* (1806): "I trod the plains he once devastated." Ashe's past-tense narrative transports the reader back to a time of these magnificent beast, and to a danger long gone, yet thrilling. He engages the modern reader going to see the exhibit in London, and takes them to a site of confrontation with a destroyed world. Ashe lost his entire collection on arrival in Liverpool. It was bought up by Bullock, owner of the The Egyptian Hall. See O'Connor, *The Earth on Show,* 31-34.

The "everyone now knows" opens the piece with clarity and unequivocal, empirical certitude. The traces of catastrophes are "indisputable" and Cuvier's favourite "destruction"—a term he uses for extinction, as well as scientific adversaries—ends the opening in assertive mood. The theme of "vast revolutions" and "destruction" is the point of departure for Cuvier in establishing his research agenda. The plot is one of mutual aid and aggrandisement through functional cooperation—evoking his "law of the correlation of parts" Cuvier was beginning to explicate in full in his four-volume *Lessons in Comparative Anatomy* (1800-1805). Literary devices appear as we go on a journey with our narrator, Cuvier; a role at this stage perhaps a little unfamiliar to him.

> Whether one digs into the plains, or penetrates into caves in the mountains, or climbs their torn flanks, one encounters everywhere the remains of organisms, embedded in more or less thick beds that form the outer crust of the globe. Immense masses of shells are found at great distances from any sea, and at heights that it would be impossible for seas to reach today; beds of shale contain fish; seams of coal display the imprints of plants at heights or depths that are equally striking. (Rudwick, *Georges Cuvier*, 45)

The tone here is still factual with passives and use of the third-person pronoun 'one', but Cuvier begins to insert trademark alliteration lending the text rhetorical force and aesthetic qualities. The "immense masses of shells" is a literary precursor to some of his most powerful writing culminating in the *Discourse*. There is tension and potential dissonance between order and disorder in Cuvier's text. The "disorder" Cuvier shows us on his journey as guide is in stark opposition to benevolent nature—she in the text, 'la nature' in the original French—that provides the habitats of species.

> In a word, just as nature has made the present habitats of living species attractive, and taken care to provide for their well-being and their conservation, so she seems to have been pleased to leave them with monuments of her power in this disorder and apparent confusion, and clear proofs of the upheavals that must have preceded the present order of the universe. (Rudwick, *Georges Cuvier*, 45-6)

These "monuments of her power", proof of past disorder, are the key to eventual understanding of any overarching grand narrative beyond the observable present for Cuvier. His goal is a naturalising of the supernatural, a reading of these "monuments" as historical documents and attendant demythologising of human and prehuman history:

> These traces of devastation have always been striking to the human mind. The legends of deluges that are preserved among almost all peoples are due to the marine fossils scattered over the whole earth. Legends of giants—no less universal—derive from bones that are larger than those of any of the [living] animals of the climates in which they are found from time to time. (Rudwick, *Georges Cuvier*, 46)

In doing so, Cuvier aims to wed the disciplines of archaeology and geology. The "traditions" of extant oral or written tradition and "monuments" of nature combine with observable "facts" of the present to provide an overarching and potentially successful theory of the earth. Cuvier had turned down the opportunity of travelling to Egypt on Napoleon's expedition; in effect, consigning himself

to being a museum-bound antiquarian and, to a great degree, resisting the role of the heroic adventurer-antiquarian that would become such a theme of Victorian Britain.[47]

Nevertheless, Cuvier knows that he depends on this mutual and reciprocal relationship of parts that enables his "reading" or "decoding" (ergo demystifying and demythologising) of the past and earth's physical history: "They have excavated in the ruins of the globe in order to find monuments of its physical history, just as antiquarians excavate in the ruins of cities in order to find monuments of the history of the crafts [*arts*] and customs of the people who lived there." (Rudwick, *Georges Cuvier*, 46) Cuvier is full of praise for those who have enabled his work through extensive fieldwork. They are the "mineralogists", not the "cabinet naturalists" of the *Discourse*. One wonders where Cuvier, himself having only carried out one piece of stratigraphical fieldwork, with Brongniart on the Paris Basin, would have placed himself on this continuum. Of course, he was a comparative anatomist, not a self-styled geologist, and was applying the tools of comparative anatomy to geology and its principal goals. In contrast to the noble adventurer-geologist on a knightly quest for truth, Cuvier seems more wizard or sorcerer reconstructing lost worlds from musty museum basements—images developed in the public imagination in Britain in the first half of the nineteenth century. (O'Connor, *The Earth on Show*)

Cuvier is certainly unequivocal in castigating "Woodwards, Whistons, Leibnizes, and Buffons" while praising the likes of "Sloane, Messer-Schmidt, Daubenton, and Pallas" (Rudwick, *Georges Cuvier*, 46) in impassioned prose. The former are men of "system", of theory and hypotheses, imposing their plot on the material at hand, believing "they were tracing a history, when it was only that of their own creation":

> The first guessed at nature rather than studying it; the others, while thinking they are only verifying the systems they admire, study it truly; and it is thus that the sciences—like peoples—pass from poetry to history. (Rudwick, *Georges Cuvier*, 47)

It is therefore through a subjugation of narrative to a project of fact-finding, data collection, observation and, of course, dissection that Cuvier hoped the history of the earth would "pass from poetry to history". This constitutes the core of Cuvier's Enlightenment project advocating the inductive methods of Bacon. The imposition of theory and hypotheses produce deductive reasoning, which, in turn, pre-determines the result. In literary terms, hypothesis is analogous to—if never

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[47] O'Connor, *The Earth on Show*, 71-116, for Buckland's consolidating of adventurer-antiquarian, and, of course, wizard. The latter could be freely applied to Cuvier, on whose palaeontological powers theirs were modelled.

wholly interchangeable with— story. However, it is striking, if not surprising, how close those elements are to an existing paradigm—that of the bible.[48] Cuvier writes:

> The principal question being to know the extent of the catastrophe that preceded the formation of our continents, it is above all a matter of determining whether the species that then existed have been entirely destroyed, or solely modified in form, or simply transported from one climate to another. (Rudwick, *Georges Cuvier*, 48)

The focus is clear. The catastrophe is a fact—the final act of a past world—but the question is the extent. This works on both macro and micro levels. The extent of the catastrophe can refer to the general-local continuum in terms of physical space. But the bodies of individual examples of species "lost" to these great catastrophes, "destroyed", also implies the lastness of extinction and how then catastrophe in its "extent" might affect individuals, not just species. These "lost" species imply three possible scientific narratives: extinction, transformation or migration. Together, for example catastrophe plus extinction, they read as story. Cuvier refuses to theorise (or offer emplotment); his strict empiricism led materialists and atheists to read his work as resistant to the forces of Catholic restoration in the First French Republic.[49] The three possible explanations tested by naturalists—that species were wiped out, that they were somehow transformed, and that they were transported away or migrated—represent the three prevalent causal explanations for fossils of species found in habitats or climates alien to their own. In effect, they also represent the three possible solutions to any organism when their habitat is threatened: be killed or wiped out, change or adapt, or move away. Equally, they represent three stories in literary writings that renew nature and our understanding of it through the natural sciences. One could argue, as Beer (*Darwin's Plots*, 3), that these structures are embedded in the culture. Indeed the similarity of all of these stories and their intersection with biblical narratives makes this a persuasive general premise. But the culture of Cuvier at this time and this place is that of France and the centre of world sciences; biblical resonances did not have the same effect. There is, however, a dissonance within Cuvier at the "general" or overarching level, where the refusal to supply scientific theory or even testable hypothesis is analogous to the structural freedom and originality of the novel. That refusal to impose external form reflects the novel's interrogation of traditional plots. Watt finds a connection between scientific enquiry and the new form of the novel. They share an integral pre-disposition to

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[48] See Beer, *Darwin's Plots*, 2. Beer quotes Eliot quoting Mackay's *The Progress of Intellect.* Mackay claims, "A remnant of the mythical lurks in the very sanctuary of science." Cuvier's work take this "remnant of the mythical" head on, but can never entirely lose the like-for-like fit. At the time, Cuvier's work must have seemed to re-imagine or rephrase the Bible. He himself states clearly that the Bible is a "miraculous" account, and to be treated as a garbled historical document.

[49] See Marzari Pencati's letter in Rudwick, *Georges Cuvier*, 86-88. Cuvier's failure to publicly dismiss geology that supported the Biblical account is see as "an appalling loss for atheists" — not without a degree of irony.

change. They are both committed to new understandings of nature and the human; two modes of modernity interrogating the natural world.

Cuvier is often portrayed in opposition to Lamarck and his transformist ideas of development or modification through intention or striving, i.e. soft inheritance or Lamarckism. I have already touched on the acrimonious relationship between the two rivals and the often extreme methods Cuvier was prepared to employ in order to maintain his position at the centre of French science. Cuvier saw no evidence for any theory of modification, based on the mummified Egyptian animal finds. However, disproving modification was of great significance. He included it in his "principal question" of, first, the extent of catastrophe(s) and, second, the fate of lost species. However, to contrast Lamarck and Cuvier as organicist and mechanist would be misleading. As discussed earlier, Cuvier's "law of the correlation" implies an integration of parts along self-organising principles. In *Species of Quadrupeds* (1801), Cuvier writes:

> In the living state, all the bones are attached to each other, and form an ensemble among which all the parts are coordinated. The place that each occupies is always easy to recognise by its general form, and by the number and position of their articulating facets one can judge the number and direction of those that were attached to it. Now the number, direction, and shape of the bones composing each part of the body determine the movements that that part can make, and consequently the functions it can fulfil. Each part in turn is in a necessary relation with all the others, such that up to a certain point one can infer the ensemble from any one of them, and vice versa. (Rudwick, *Georges Cuvier*, 50)

The synecdochal relationship of part and whole, whole and part, implies an intrinsic structure. Ergo, this is not an "animal machine", but a living and self-sustaining organism where every part speaks of the entirety. This internal organisation of the animal is, to a degree, deterministic in the sense that it inevitably can only fulfil the functions each part makes possible for the whole. It reads as a soft organicism, with distinctly mechanistic elements. Even external factors i.e. habitat or environment described as "conditions of existence" were part of this synecdochal metaphor:

> […] when the teeth of an animal are such as they must be, for the animal to feed on flesh, we can be sure without further examination that the whole system of its digestive organs is adapted for this kind of food, and that its whole framework, its organs of locomotion, and even its sense organs, are made in such a way as to make it skilful in perceiving, pursuing, and seizing its prey. In effect, these relations are the necessary conditions of existence of the animal, and it is evident that if things were not so this animal could not subsist. (Rudwick, *Georges Cuvier*, 50)

The inference from teeth to prey to skills and behaviours demonstrates an organism perfectly adapted to environment. For Cuvier these are its "conditions of existence" and do not represent divine organisation in the natural world. On the contrary, they are the conditions for not being destroyed—for survival. Cuvier's term, subsist, does not stir the emotions; it is not romanticised or idealised. There is no need to find some terrible beauty or sense of the sublime in order to justify

God's works as in British texts within the tradition of natural theology.[50] In fact, Cuvier's working belief in "destruction" over modification and transport means these creatures were perfectly adapted. This order and self-organised unity from part to whole of organism and environment imply various possibilities in regard to literary strategies. First, it could imply an Edenic perfection akin to a state of lost grace, a superstructure of innocence as analogy, and even literally.[51] Disconnected from any greater teleological scheme or even historical continuity this ancient world could be seen as a prehistoric heaven—as well, of course, as a prehistoric hell.[52] Second, Cuvier was clearly claimed by materialists and atheists alike as anecdotal evidence testifies.[53] The proposed "anti-structure" of scientific enquiry and the novel could produce resistance to religious elements regaining power and confidence after the Republic. Just as its lack of story left it open to imposition of external meaning. Third, the dissonance between the internal functional unity and principles of organisation, and the general lack of theory, hypothesis or story create what Rudwick (*Georges Cuvier*, 197) describes as being "vague, inconsistent and even incoherent" in Cuvier's representation of nature. Ironically, this inherent instability produces a Gothic and Romantic mood, in spite of its thoroughgoing project of empiricism. As Cuvier contested repeatedly, there was not enough evidence for any unified theory of the earth. The end result of perfect organisation within absence of organisation or "anti-structure" is either comedy or tragedy. The relationship to the novel and its rejection of traditional plots becomes even further nuanced. The production of comedy or tragedy suggests an intertextuality and continuity with older forms and genres.

Cuvier's disagreement with Lamarck on transformism was based on insufficiency of cause; Cuvier saw no evidence of transmutation from the mummified animals of ancient Egypt to their present-day counterparts. Moreover, Cuvier follows through Lamarck's line of thought, questioning whether successive degenerations could all be from an original single species:

> Whatever may be the influence of climate to make animals vary, it surely does not extend this far. To say that it can change all the proportions of the bony framework, and the intimate texture of the teeth, would be to claim that all quadrupeds could have been derived from a single species; that the

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[50] Levine, *Darwin and the Novelists, 24-55,* for an aesthetic literary approach; Conlin, *Evolution and the Victorians,* for a history of science approach.

[51] See Abrams, N*atural Supernaturalism,* for a discussion of how biblical structures of innocence, fall and redemption persist through Romantic literature.

[52] O'Connor, *The Earth on Show,* 301-315, for depictions of prehistoric hells.

[53] See Marzari Pencati's letter in Rudwick, *Georges Cuvier*, 86-88.

> differences they show are only successive degenerations: in a word, it would be to reduce the whole of natural history to nothing, for its object would consist only of variable forms and fleeting types. [54]

Clearly, the rigidity of previous worlds separated by catastrophes, their fauna and flora destroyed by cataclysms, produced a familiar story. This natural history consisting "only of variable forms and fleeting types" is a precursor to the evolutionary world; a world realised only after Cuvier's death in 1832, Lyell's gradualism of the 1830s and of course Darwin's Development Hypothesis. But British fiction was infused with both Lamarckian, and, more importantly anti-Lamarckian, narrative in the first half of the nineteenth century. Indeed, Cuvier's containment of Lamarck would soon spread over national borders.

Cuvier also intones for the first time, in *Species of Quadrupeds* (1801), the suspicion that fossils come from different ages—that some form of succession of natures or varieties in nature are evident in the fossil record and can be read stratigraphically: "the older beds […], the more they differ from those of animals that we know today" (Rudwick, *Georges Cuvier*, 52). Cuvier initially supported a discrete division between ancient world and present, a binary partition he shared with Deluc. However, a new nature no longer "complete and unchanging" produced new modes of narrative. He finishes this paper in ebullient mood, boastful in his claims for "physics". Brimming with confidence, he questions i) anthropocentric values in underlining this "primitive nature" not being "submissive to the empire of mankind", ii) metaphysics i.e. philosophy in being inadequate in providing useful models of existence, and iii) the "new production of organisms" which constitutes a direct assault on a biblical special creation (something Cuvier would likely have abandoned already).

> If so many lost species have been restored in so little time, how many must be supposed to exist still in the depths of the earth! How much will the ideas we already had about the revolutions of the globe be enlarged by these circumstances that were hitherto unknown: animals that formerly lived on the earth's surface, buried under entire mountains; between them and the present surface, traces of the successive passages of seas; an earth, a primitive nature, which was not at all submissive to the empire of mankind, and of which only some half-decomposed bones remain to us! How were these antique organisms destroyed? Is not metaphysics itself even more embarrassed by these facts than simple physics? And is not this new production of organisms perhaps more inconceivable than any other part of the phenomenon? (Rudwick, *Georges Cuvier*, 56-7)

By the time Cuvier went into the public lecture circuit in 1804-5 the political climate had changed with the rise of the First French Empire. Rudwick notes the uncertain political position of geology because "it claimed to have authority to pronounce on the relation of the human—and therefore social—world to the world of nature". (*Bursting the Limits,* 449) There is scant evidence for these

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[54] Cuvier. *Species of Elephants*, 1799, pp.12.

lectures, but what evidence does remain—preliminary notes for lectures at the Athenaeum and a synopsis of subsequent lectures by Swiss nobleman Giuseppe Marzari Pencati (1779-1836)[55]—point to a Cuvier espousing more conservative and conventional views to the point of disappointing Pencati, studying with Faujas at the time. Both confirm Cuvier's tracing of a historical geology and history of the earth where life had emerged on earth, and both the earth and life had undergone a succession of different forms and changes. Cuvier was dismissing any possible transformist interpretations due to lack of evidence of any organic change since the time of the Egyptian mummies. Instead, extinction through catastrophic events remained his mechanism for succession. These events could be both local and general, like the last, in nature.

Pencati's letter and summary of Cuvier's lecture provide evidence of what the free-thinking genteel class expected of Cuvier having read his work. His uncritical acceptance and mediation of Buffon, Deluc and Dolomieu heralded a return to a more cautious theory of the earth seemingly less at odds with Mosaic geology. Rudwick (*Bursting the Limits,* 454) concludes that Cuvier is treading a politically correct middle way between the short timescales of a newly exuberant post-Concordat biblical literalism and Lamarckian eternalism. Pencati dubs the course "Comparative anatomy applied to geology" and constantly puns on Cuvier's perceived allegiances:

> It wasn't without astonishment—knowing he is hardly very devout—that I heard him wanting to have all his corollaries in the service of proving the opinion of Dolomieu, Saussure, and the two Delucs, about the newness of our present continents. The Holy man doesn't assign them even ten thousand years. (Rudwick, *Georges Cuvier*, 86-7)

Aside from acceptance of more conventional chronology in earth history, Cuvier obviously quips and makes jokes at the expense of transformists. However, it is clear from Pencati's text that more was hoped from Cuvier on account of his papers and diverse publications:

> It seemed to be in good faith, and it must be admitted that it's an appalling loss for the atheists, who were proud in advance of what the great Cuvier would deduce from his zoology and his zoological geology. Calculating from his former prejudice, they had already announced, as his, some opinions that were scarcely his at all. (Rudwick, *Georges Cuvier*, 87)

This political ambiguity of Cuvier begins early in his scientific career, and is the hallmark of a survivor. His resistance to "systems" and theory, as had already been noted, produces historical science without a consistent overarching narrative, in an area where there already exists an established tradition. Cuvier himself often notes the need for speculation in this area but normally assigns it to moral and political science, or metaphysics. Pencati's ironic tone contrasts "Holy man"

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[55] See Rudwick, *Georges Cuvier,* 74-88, for a discussion of Cuvier's public lectures and translations of Cuvier's notes and Pencati's letter. See also Rudwick, *Bursting the Limits of Time*, 449-456, for a full exposition of the political climate during the period and a full account of Cuvier's lectures.

with “hardly devout”. He continues by jesting that Cuvier was fishing for a promotion with his “Mosaic opinion”:

> To decide whether he is or is not in good faith, I will add for you that, having started his course when the pope had just arrived [in Paris], and having set out for us in the beginning his altogether Mosaic opinion, I thought at first that the good devout man was simply on the lookout for a cardinal's hat. This conjecture was not extravagant in a city where all are flatterers, and at a time when everyone is changing position. (Rudwick, *Georges Cuvier*, 87)

Without the full text of the lectures it is difficult to assign significance to such anecdotal evidence. It does, however, serve to point up two truths about Cuvier: first, that his work in applying fossils to theories of the earth was quickly and freely appropriated to different and conflicting schools of thought and polemics. This is true at this early stage of his career just as it was later: biblical literalists and atheists, radicals and reactionaries, literati and scientists all called on Cuvier to legitimate their views or ends. Second, that in spite of his inconsistencies and even when his integrity was being questioned, respect and authority were always granted to his method and his work. Pencati similarly relents after his bout of ironic jests:

> But I promise you I've gone back on that suspicion completely, and I believe he's sincere, apart from the jokes, for he led us step by step without any sophisms, as far as I could tell. (Rudwick, *Georges Cuvier*, 87)

It seems, or Pencati claims, that Cuvier could not disguise a false argument by dressing it up in rhetoric. This may point to a man less comfortable in the performative arena of the public lecture theatre, because, in contrast, in the *Discourse*, Cuvier was to, according to Rudwick (*Georges Cuvier*, 173), produce a “masterpiece of scientific prose”.

In order to perpetuate and advance his career, Cuvier had to respond to the prevailing political climate; his scientific practice has to be seen in light of his context. He successfully differentiated himself from predecessors and contemporaries and applied comparative anatomy to geology creating a new discipline, palaeontology. The power to speak for nature was truly his, the grand narrative of nature shifts with Cuvier to speak of revolutions and catastrophes underscored by extinction. These dual mechanisms resonate in a destabilised Europe and the radical political forces throughout the continent. Fossil plots imply a new power structure in nature where the traditional might be swept away—at the same time, Cuvier’s method of *charpente* and its inherent synecdochical logic privileges the individual over types, the particular over the universal, empirical experience over universal absolutes, but is met by Lamarck and individuals and groups who can actively change theirs. What is the role of the individual? What does the functional harmony at the heart of Cuvier’s nature mean for the individual? Does it empower the individual or reduce it to a type? Transformism seems to offer individual intention and change, not just through inheritance or

birth, which is what Darwin seems to reinforce; birth is everything in a genealogical reordering according to traditional lines. The surviving individuals of Cuvier's restorations tell stories of extinctions, but also of survivors—what do those survivors mean? They do not survive by birth. They have prospered through a kind of functional integration to the environment, but not through any greater purpose. Are they then simply "animal machines"? Or are they the means for species survival?

Summary

Cuvier's papers from before the First French Republic represent a movement to the centre of scientific authority in Paris. From early exposure to Buffon and Deluc, Cuvier's two papers *Species of Elephants* and *Species of Quadrupeds* chart the rise of competing science practice and knowledge through Directory Era France. Cuvier's "bones alone" empiricism propels him to scientific legitimacy. The "law of the correlations of parts" may represent a grand science narrative to challenge Buffon. Cuvier's empiricism reflects the "naive empiricism" integral to the emergent novel genre.[56] Indeed, the very "anti-structure" of these modes define them. Unquestionably, Cuvier changes any widely accepted grand science narrative. But many science stories have been identified such as extinction, transformation and migration in response to the question of fossils. They all pose similar problems in trying to produce new understandings of nature that answer the particular questions of the individual interrogating modernity.

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[56] McKeon, *Theory of the Novel*, 384.

4 The Preliminary Discourse

Tucked within the various papers on fossil pachyderms (*Living and Fossil Elephants*, 1806 & *Teeth of the Mastodon Genus*, 1806) is further evidence of Cuvier changing his position on flood geology or *diluvialism* and the possible "extent" of the catastrophe(s) that had befallen the world. Various statements, if taken in isolation, seem to support a general catastrophe and marine inundation that can then be equated with the biblical flood—in fact, one might further add that it would be impossible, and still is, not to equate it to it. Cuvier writes in *Living and Fossil Elephants* (1806): "Everything seems to indicate that the event that buried them [fossil pachyderms] was one of the most recent that has contributed to changing the surface of the globe. This was nonetheless a physical and general event." (Rudwick, *Georges Cuvier*, 92) This kind of unequivocal statement taken apart from the body and general rhetoric of his work could easily fuel the fire of biblical literalists, ready to appropriate Cuvier, *the* authority on fossils and the ancient world. It has already been noted that religious traditionalism had renewed vigour in the Napoleonic Era after the 1801 Concordat. Francois Auguste René de Chateaubriand's popular *Genie du Christianisme* (1802) expressed young-earth geology in line with scriptural accounts. Cuvier asserts that these extinct creatures (fossil pachyderms) were subject to "a revolution that made all the existing individuals perish, or by a change of climate […] But whatever this event may have been, it must have been sudden." (Rudwick, *Georges Cuvier*, 93) Flood stories naturally connect to and interrogate biblical myth, even more so under a period of conservative religious reaction. Cuvier's use of "existing individuals" instigates two questions: first, does the palaeontological focus on individuals produce particular meaning? Second, does that meaning then intersect with the novel's focus on individual experience? The use of "individuals" is indicative of his resistance to transformism and a natural history "only of variable forms and fleeting types" (*Species of Elephants*, 12). Beer notes in *Darwin's Plots* (6) that: "The optimistic 'progressive' reading of development can never expunge that other insistence that extinction is more probable than progress, that the individual lifespan is never a sufficient register for change or for the accomplishment of desire". The frozen quadrupeds in the Siberian wastes capture that life-moment of just "individuals" and Cuvier similarly resists a transformist paradigm that leads to subjugation of individual to species, to "variable forms and fleeting types" (*Species of Elephants*, 12). Beer is of course discussing Darwin, if often anachronistically reinserted to earlier Victorian thinking. Moreover, it should be remembered that Darwinian evolution takes place at the instance of conception through sexual procreation. In stark contrast, Lamarckian transformism offers change through use or disuse of functions. This means

that individuals can knowingly change their circumstances, they have agency regardless of their station in society, hence its revolutionary tenor. But the phrase "extinction is more probable than progress" in Beer (*Darwin's Plots*, 6) underlines the contradiction of the importance of the individual and the probability of extinction in Cuvier. In context, it is essential to remember Cuvier's principle project as ascertaining the "extent" of the catastrophe and then assessing extinction, modification or transport as probable outcome. Extinction clearly prevails: "the hypotheses of a gradual cooling of the earth, or of a slow variation in either the inclination or the position of the axis of the globe, collapse by themselves" (Rudwick, *Georges Cuvier*, 93).

In his paper *Teeth of the Mastodon Genus* (1806), Cuvier summarises his "geological" position apropos of the fossil pachyderms which he confirms osteologically as both distinct and extinct species. His conclusions are fourfold. First, that the extinct species were "buried in the last or one of the last catastrophes of the globe" (Rudwick, *Georges Cuvier*, 96). Cuvier's use of the flood often misleads. He states clearly in *Report on Mr. André's Work* (1807) that: "the Deluge is presented in *Genesis* as a miracle" (103) Cuvier presents a "succession" of worlds and natures. His mechanisms are catastrophe and extinction contra transformation or degeneration.[57] His second conclusion is that, "The catastrophe that buried them was thus a major but transient marine inundation" (96). This does not seem a clear indication of extent in terms of general or local. However, transience points to the next conclusion that, third, permanent climate change was not the cause:

> Thus, before this catastrophe, these animals lived in the [same] climates where their bones are now unearthed. It is this catastrophe that destroyed them there; and since they are no longer found elsewhere, it must indeed have annihilated the species. (Rudwick, *Georges Cuvier*, 96)

Cuvier's position against permanent climate change must be read in relation to Buffon's theory of the cooling earth and Lamarck's meteorological approach to transformism in *Hydrogéologie*. His previous distinction between modern and ancient world is replaced by continuity and clear possibility of a process of succession in the "variations that organised life has undergone on earth" (Rudwick, *Georges Cuvier*, 125). The fourth conclusion Cuvier reached was that extinction — not transport, not transformism—was the engine of change on earth:

> Nonetheless, nothing authorises us to believe that the tropical species are descended from these ancient northern animals, transported either gradually or suddenly toward the equator. They are not the same; and we shall see, from an examination of the oldest mummies, that no established fact

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[57] At this point one or two clear plots are emerging in Cuvier's work. First, catastrophe then extinction, leaving something new and different to restart afterwards. Or catastrophe then survival, leading to repopulation. The second of these is really a naturalised version of the biblical accounts and those in Ovid's *Metamorphosis* and Milton's *Paradise Lost*. Destruction is always avoided, a new cycle started. In simple, universal terms this kind of plot is inevitable. Something bad happens, you either survive it and get on with your life, or not.

> authorises us to believe in changes as great as those that it would be necessary to assume for such a transformation, especially in wild animals. (Rudwick, *Georges Cuvier*, 96)

If this breakdown between modern and ancient world, between known and unknown causes, is weakened then an even greater dissonance arises. The historicity that Cuvier advocates—the antiquarians of nature, reading the earth as text—implies other forces and mechanisms of continuity which remain unexplained. The pachyderms belonged to a "more ancient epoch" and "differ far more […] from all animals alive today" (Rudwick, *Georges Cuvier*, 97). Indeed, they differ more than those in between. Cuvier voices this dissonance: historicity implies continuity and linearity. The "lost" worlds and species in the pockets of time that Cuvier had "burst" through to had previously implied a possibility of circularity, of worlds former and future. But this linear, historical perspective implies a single grand narrative; a continuity of purpose and form for which Cuvier claimed to be providing equally rigorous evidence. He states: "one is authorised to believe that there has been a certain succession in the forms of living beings" (124) in the 1810 *Historical Report on the Progress of the Natural Sciences since 1789*. It might be tempting to read too much into the use of "succession" at the specific political period, with kingly succession to be reinstated in 1815. In this sense, scientific organicism might be dovetailed with political organicism stressing continuity and tradition contra the sudden and violent political and social revolutions of the near past. The preparation of the *Historical Report* for Napoleon and fieldwork with Brongniart, begun at the same time as the public lectures of 1804-5, led Cuvier into a new understanding of and immersion in geology. Rudwick notes that, with the founding of the Geological Society in London in 1807 and its adoption of Baconian principles of observation and induction, and the dismissing of speculative theories of the earth, one can now refer to geology and geologists without anachronism (Rudwick, *Bursting the Limits*, 468). As noted above, the unchallenged assumption of the discrete division of modern and ancient world was collapsing. For Cuvier this meant a new narrative in dating fossils, and through dating fossils, dating the earth.

Preliminary Discourse

Géographie minéralogique (1808) was the first piece of Cuvier's work widely translated into English by the Council of Mines in 1810. It exhibits none of the elegant prose at its peripheries as previous papers have demonstrated. The Paris Basin work would be included in full in *Fossil Quadrupeds*, and its English translation. Its pictorial cross-sections offer a two-dimensional physical representation of a "succession" of worlds punctuated by change on a massive scale, and

permanent in effect. In many ways, it completes Cuvier's call for a "new species of antiquarian" (Rudwick, *Georges Cuvier*, 171), tied to archaeology, reading the historical documents like a mighty palimpsest of the past. Cuvier's fossil and geology work was completed in 1812 with the release of *Researches on Fossil Quadrupeds.* This included all his research on fossil bones and the *Geology of the Paris Region* (1808) and a new essay to tie the works together aimed at the general reader: the *Preliminary Discourse*. With it, his research in fossils and geology came to an abrupt end. The work was dedicated to Laplace whose *Celestial Mechanics* (1799-1825) was widely seen to have completed Newton's work. Cuvier invokes the "rigorous spirit" of mathematics, seeking association of naturalist and mathematician, and underlining the efficacy of his project to "burst the limits of time", just as Newton and Laplace had done with space. In the Preface, Cuvier speaks of fossil bones as "charters and diplomas" (Rudwick, *Georges Cuvier*, 171), their significance achieved—a testimony to Cuvier's work that he now may put aside. Then, in what might at first seem a flippant twist, Cuvier disowns his conclusions in the *Preliminary Discourse*:

> The author in no way clings to these conclusions; indeed they enter into his work only as digressions appropriate to reduce somewhat its monotony; and if anyone can draw better ones, he will be the first to abandon his own. (Rudwick, *Georges Cuvier*, 171)[58]

Is Cuvier joking with us? Surely he could see the irony in distancing yourself from your life's greatest work to date—an amalgam of all your endeavours—just in your moment of triumph? But this triune of i) objective distance, ii) speculation being part of the territory hence "digressions", and iii) commitment to scientific method as a slow and attritional process (as opposed to sudden and violent change[59]) seems an embodiment of the Cuvierian spirit that is invoked by geologists, novelists and dramatists alike throughout the first half of the nineteenth century and beyond. The commitment to abandoning any overarching grand narrative he may have implied demonstrates his championing of empirical uncertainty over externally imposed order. For Cuvier, order could only be found from within through his anatomical principles. The third-person perspective underscores this distancing; the author is already detached and depersonalised. Cuvier had been given an administrative post within higher education. He was offering up his work to a new generation to explore the extent or limits he had burst. Cuvier was to enjoy his hard-won political success by concentrating on comparative anatomy and went on to produce *The Animal Kingdom* (1817), producing an updated taxonomy of life on earth. Of course, he became embroiled in debates with

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[58] Translated from the Avertissement" in Cuvier, Ossemens fossiles (1812), vol. r, pp. i-vi.

[59] Contrast with Beer (*Darwin's Plots*, 1) paraphrasing Claude Bernard from *The Cahier Rouge of Claude Bernard* that "science proceeds by revolution and not by addition pure and simple". Cuvier, supposedly an arch-catastrophist, would have said the opposite. He would have wished to align himself with mathematics and distance himself from scientific revolutions — unless they were the slow kind he imagined in contrast to his catastrophes.

Geoffroy through the late 1820s and early 1830s. But for English-speaking general readers the *Discourse* would be their point of access to Cuvier in the original for years to come.

That legacy, of course, is embodied in the essay for the general reader attached to the work: the *Preliminary Discourse*. Cuvier refers to it as an "essay on a small part of the theory of the earth" in the opening paragraphs, a complete and overarching theory of the earth being something he thought largely unobtainable. But this formulation would grace the title page of Jameson's English translation—minus the qualification "a small part of". Cuvier understands the need to communicate his "digressions" and finds a language and tone that can interconnect with the romance and the epic nature of his subject.

> As a new species of antiquarian, I have had to learn to decipher and restore these monuments, and to recognise and reassemble in their original order the scattered and mutilated fragments of which they are composed; to reconstruct the ancient beings to which these fragments belonged; to reproduce them in their proportions and characters; and finally to compare them to those that live today at the earth's surface. (Rudwick, *Georges Cuvier*, 171)

The fourfold repetition of this fabulously monstrous sentence might evoke in the modern reader thoughts of the epic science-fiction adventure-romance of Gene Rodberry's *Star Trek*. Cuvier might have said no to Egyptian expeditions and basically renounced the Romantic ideal of the adventurer-naturalist for the wizardry of the magical museum curator, but his self-portrayal here is premeditatedly Romantic.[60] The use of "new species" itself constitutes a wry and ironic quip at the unprepared reader's expense: Cuvier is reforging human character like a new "capital-C" creation. His skills "to decipher", "to restore", "to recognise and reassemble", "to reconstruct the ancient beings", an endless sequencing of to-infinitives, are nothing short of miraculous. They constitute a new kind of science that, just as electricity or magnetism, would have seemed like magic to the uninitiated. He reads the unreadable, decodes "mutilated fragments", boasts impossible knowledge and a new understanding of, and power over, nature. Moreover, it is not the fresh air of mountains we scale (at least not yet), but into the dark and musty basements of arcane wisdom we must delve. Cuvier's "monuments" are everywhere: "they make up the whole mass of the ground" (Rudwick, *Georges Cuvier*, 185). To some degree, therefore, he privileges the flame of Enlightenment knowledge over the heroic adventurer-geologists conquering the great unknown on behalf of confident empire—though he too scales heights and sows the seed of empire in his prose in the *Discourse*. In Cuvier conquering is an act of restoration. But even as he restores "original order" this necromancer reassembling the dead and bringing them back to life denies fealty to any greater

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[60] See O'Connor, *The Earth on Show*, 61-64, for Cuvier's self-image as antiquarian.

purpose or ultimate cause.[61] This doubleness or dissonance between order and disorder, between predetermined plot and nebulous narrative, is part of Cuvier's texts that resounds in the literary writings examined later.

Cuvier's delving into the "concealed" and "lost" past of the earth may represent a dismissal of overarching story in the *Discourse.* But his ability to "burst the limits of time" and leap "in the darkness of the earth's infancy" (Rudwick, *Georges Cuvier*, 185) produces story in spite of the fragmented perspective:

> Would there not also be some glory for man to know how to burst the limits of time, and, by some observations, to recover the history of the world, and the succession of events that preceded the birth of the human species? (Rudwick, *Georges Cuvier*, 185)

Section *[3] The Earth at First Glance* implies the act of looking at the earth for the first time, a feat only possible for an imagined otherworldly visitor.[62] This raises questions of who the "traveler" is who "crosses fertile plains" (87) in Cuvier's guide-journey through space and time. Cuvier parallels human and natural history; the human enabled by "tranquil rivers", "fertile plains" that "sustain abundant vegetation" producing "villages", "cities" and "monuments" but destroyed by the "ravages of war". Similarly, nature is not without "its civil wars", "upset by successive revolutions and various catastrophes" (187). The two adjectives, "successive" and "various" may imply continuity in time of the slow and general processes of revolution, set against the spatial and temporal randomness and specificity or localness of catastrophe. But these "civil wars" are not evident at "first glance":

> But his ideas change as soon as he seeks to excavate this ground that today is so peaceful, or to climb onto the hills that border the plain. His ideas enlarge, as it were, with his viewpoint. (Rudwick, *Georges Cuvier*, 187)[63]

This physical and spatial journey into the earth, its caves and grottos, and up into the mountains, with "bristling and naked peaks" (Rudwick, *Georges Cuvier*, 191), away from "tranquil rivers" and "fertile plains" leads us to this "viewpoint" where "ideas enlarge" (Rudwick, *Georges Cuvier*, 187). The spiritual quest for supernatural knowledge, truths or laws resonates with biblical stories, of Moses ascending Mount Sinai to receive God's law—reminding us of Mackay's claim that: "a remnant of the mythical lurks in the very sanctuary of science".[64] But Cuvier makes it clear that the bible presents itself as miracle and that the bible is to be read as a historical document—not

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[61] See O'Connor, *The Earth on Show*, 87, for Cuvier as restorative wizard.

[62] See O'Connor, *The Earth on Show,* 251-2, 366-7, for extraterrestrial beings as narrative devices in science literature.

[63] See Buckland, *Novel Science,* 321n, for Buckland's use of this quote via O'Connor.

[64] Beer, *Darwin's Plots*, 2.

privileged over nature's "monuments". Cuvier tells us: "These great and terrible events are clearly imprinted everywhere, for the eye that knows how to read history in their monuments." (Rudwick, *Georges Cuvier*, 187) The traveler can begin to read this history in the high places and the low:

> They begin to encompass the extent and magnitude of these ancient events, as soon as he climbs the higher chains of which the [foot]hills cover the flanks, or as he penetrates into their interior, following downward the beds of the torrents. (187)

For Cuvier fossils are the key to this "vision". They make up the very stuff of the earth, not "sports of nature"; a point he hammers home with insistent internal repetition: "All parts of the world, all hemispheres, all continents, all islands of any size: all show the same phenomenon." (Rudwick, *Georges Cuvier*, 187) Fossils are the key to the grand narrative of earth history, to its sequencing through "successive revolutions" and "various catastrophes" that are Cuvier's mechanisms for "a series of epochs anterior to the present time" (192). They tell a story of "a succession of variations in animal nature" (189) and a history of life on earth.

Cuvier's lengthy departure into "traditions" or textual evidence for the recent emergence of the continents and the last major catastrophe are perhaps misleading to the casual reader. It completes the metaphor of "monuments" and nature's antiquities, at once uniting human history and prehuman history, archaeology and geology, textual document and fossil bone. However, it does add to the confusion surrounding Cuvier's position on revolutions, catastrophes and, in particular, the last great catastrophe that he identifies with the biblical flood—alongside, it should be added, other oral and written traditions. In section 36, 'All known traditions make the renewal of society reach back to a major catastrophe' (Rudwick, *Georges Cuvier*, 239-246), Cuvier surveys sources from the Mosaic account in the bible to "an alternation of revolutions, some operated by water, the others by fire" originating in Egypt but spread to Assyria and Etruria; from the Yao myth of China (244-5) to the Indians and "the successive destructions" (244) the earth has undergone; from the Greeks' "earth repeopled by Deucalion" in Ovid's *Metamorphoses* to Zoroaster. He suggests: "the incoherence of all these narratives […] indicates equally the recentness of their establishment; and that recentness is itself strong evidence of a major catastrophe" (243-4). Cuvier goes further in the last lines of the 1812 *Discourse* ending: "Thus all the nations that can speak to us testify that they have been renewed recently after a great revolution of nature." (246)

There is inconsistency (perhaps "incoherence" as Cuvier identified in primitive narratives) in this last "great revolution". It clearly serves Cuvier's purpose to prove a major catastrophe event in order to disprove eternalist and transformist accounts from Lamarck and Geoffroy. Lamarck publicly accepted his assessment of the Egyptian mummified animals as proof of no modification in

that timescale. If Cuvier could find evidence of this last general event then modification or transformation was seemingly disproved. In addition, the resurgence of traditional Catholicism and biblical literalism ensured Cuvier's need to tread a politically correct middle path. But the result is a confusing plurality of possibilities in Cuvier's text. There are general revolutions punctuated by local catastrophes, a mix of the slow and successive contra the sudden and violent, not depending only on "a gradual and general retreat of the waters, but on various successive advances and retreats":

> Thus the various catastrophes of our planet have not only caused the different parts of our continents to emerge by degrees from beneath the waves; it has also happened several times that areas made into dry land have been covered again by water, either by having subsided or because the water has simply risen over them. (Rudwick, *Georges Cuvier*, 189)

At the same time, there are unequivocal assertions that these are not gradual processes, but sudden and repeated inundations as the *Geology of the Paris Basin* demonstrated with its changes in freshwater and seawater fossils between strata: "These repeated advances and retreats have not been slow at all, nor achieved by degrees; most of the catastrophes that led to them have been sudden." (Rudwick, *Georges Cuvier*, 190) Nor is the agency limited solely to water in liquid state. The large quadrupeds of the north—individuals preserved with "skin, hair, and flesh" in ice—demonstrate the workings of an "eternal frost" which "could only have taken hold of the places where these animals lived by the same cause that destroyed them: the cause was thus as sudden as its effect." (190) Cuvier's "revolutions"[65] are numerous, sudden, possibly "major", and, in the case of the last, coinciding with the myths and traditions of nations spanning the globe. But Cuvier also introduces a third factor, that the revolutions of the globe are becoming "steadily less deep and less general" (190). This process of lessening in power and localising of catastrophe is an important idea and distinction. Originally, he distinguished between the modern and ancient worlds; a binary division of different processes and causes. But rather than a discrete division he expresses a more gradual process here. But whether a straight dichotomy or a gradual change, this vision of a world somehow stabilised, and of a threat lessened or even neutralised, provides a very different story. First, catastrophe and danger seems to have been averted; it is a thing of a past age—a sort of opposite to a golden age or one of innocence. Instead, the past is more a prehistoric hell, a danger averted, and as a result, a sensational escapist attraction to be entertained by from the safe distance

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[65] Rudwick notes that the use of the word "révolution" rendered as revolution (contra catastrophe) would not have been confusing for his contemporaries. However, it must be noted that Cuvier interchanges revolutions and catastrophes in a confusing manner. They are not clearly defined terms as we would expect today. Revolutions do generally refer to slower and more gradual processes, rather like the rise and fall of civilisations. In these sections, however, Cuvier seems willing to mix them freely. Whether revolutions retains the meaning of a more general event and catastrophe a more local one is doubtful, as there are always regular exceptions.

of the present.[66] Second, it is an earth history showing progression from an earth "disturbed by terrible events", "calamities" that "shook the entire crust of the earth to a great depth" (190). It shows similarities to Buffon's cooling earth theory in that the earth and its climate are somehow becoming more hospitable—before, of course, an ultimate icy end in Buffon's frozen world. Third, it enacts a plot where the earth is repeopled and nations renewed; where the drama does not consist of catastrophe-extinction, but instead catastrophe-survival-renewal. However, it does not replay biblical structure—the age of innocence, the Golden Age, is not part of the reconfiguration—and with the upheavals of the earth lessening gradually the grand narrative may point instead to a golden age ahead. Politically, of course, the Bourbon Restoration was ahead in 1815, but even the Napoleonic Empire could be interpreted as a far more politically stable period than the Revolution and Republic.

Cuvier's "renewal of society" introduces another, fourth possibility that the earth was peopled before the catastrophe. It is developed in the 1821 second edition where: "in this revolution the countries in which men and the species of animals now best known previously lived, sank and disappeared". But, at the same time, it is set against a survival-renewal plot where a "small number of individuals spared by it have spread out and reproduced". Then finally it is questioned again and left unresolved: "But these countries that are inhabited today, which the last revolution laid dry, had already been inhabited previously, if not by men then at least by terrestrial animals." (Rudwick, *Georges Cuvier*, 248) Cuvier also confirms an "astonishing" prehuman world, and, moreover, "that life has not always existed on the globe" (190). Cuvier does not dwell on origins, but his grand "anti-narrative" (Secord, *Introduction, xviii)* explores the same tension found in the bible, Ovid and Milton. In *Metamorphoses*, when Jove declares "all must perish", the pantheon of gods questions the purpose of a world without mankind asking: "What form shall earth of him depriv'd assume?" (1.280). There is an audible dissonance between a world without life, or humans, or meaning and human sense-making narratives producing self-affirming, anthropocentric plots. Cuvier actively mocked his predecessors whose theories of the earth he deemed simple fictions; the "Woodwards, Whistons, Leibnizes, and Buffons" (Rudwick, *Georges Cuvier*, 46) whose science was more "poetry" than "history" (47). Cuvier's "anti-narrative" provided a dissonant, discordant and Gothically indeterminate account of a world perhaps best kept in the past and observed as escapist fantasy from the safety of the present.

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[66] See O'Connor, *The Earth on Show,* 301-315, for a discussion of prehistoric hells.

Cuvier examines causes still operating today in section 8 of the *Discourse*. In comparison to early theories of the earth, Cuvier sees his position as a minority one and as an innovator. He considers their attempts to reconcile religious belief in sacred history and observations of the natural world as misguided. His position is therefore new and modern, theirs outmoded: "it has long been thought possible to explain earlier revolutions by these present causes, just as past events in political history are easily explained when one knows well the passions and intrigues of our times" (Rudwick, *Georges Cuvier*, 193). In his first draft he had written "the history of nature is private", a striking idea which feels remarkably modern. This leads him to his most eloquent enunciation of present and past causes in another similarly striking analogy:

> The thread of operations is broken; nature has changed course, and none of the agents she employs today would have been sufficient to produce her former works. (Rudwick, *Georges Cuvier*, 193)

Cuvier's turn of phrase is intriguing in evoking the Fates, the Greek *Moirai*. It draws upon the Graeco-Roman mythology of destiny and the three sisters who weave the threads of every individual's fate. At the same time, the insertion of "operations" suggests a more mechanical process such as that of the textile looms of the Industrial Revolution. A broken thread constitutes a mechanical stop in the function of machinery; the mythical and mechanical are combined. Similarly, a broken thread represents the death of the individual at the hands of *Atropos* the "unturning" or "inevitable". This breaking of the thread, moreover, works symbolically as suggestive of the separation of Cuvier from the Burnets and Leibnizes, the Whistons and Woodwards of the past; of geology from theories of the earth.

The irony and strange doubleness of Cuvier's so-called "catastrophism" is that it preaches a present where "nature has changed course" from her previous turbulence and upheaval. Cuvier argues for a present calm and past upheaval; a nature turned from disorder to order. Later gradualism finds disorder and upheavals in the present as well as in the past. It only presents itself rhetorically in opposition to that which precedes it, just as Cuvier does from the theories of the earth that preceded him. Cuvier's "catastrophism" dovetails with the broader culture of spectacle in the arena of popular public science. Its duplicity offers both disorder and order, danger and safety, destruction and civilisation in the same breath. The revolutions of the globe, its disasters and catastrophes, become a commercial success in the period.[67] The monsters and catastrophes of a world beyond reach can be safely consumed at the expense of the physical and political upheaval and revolution of the time.

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[67] O'Connor, *The Earth on Show*, his main thesis is that earth history becomes part of a culture of spectacle in Victorian Britain.

Is Cuvier then complicit in the myths of empire and progress that give the common man what he wants—a latter-day Colosseum—while serving the forces of reaction and oppression? To underline the inadequacy of present causes to produce previous effects, he adopts a new tone in the *Discourse*. Rivers and watercourses, sedimentation, are a civilising force and an enabler of human civilisation. In section 10, 'Alluvia', Cuvier commences with "The waters that fall on the ridges and peaks of mountains […] run down their slopes in an infinity of trickles […]", and traces their passage down and out to the river mouth and delta of civilisation itself:

> They end by forming land there, which extends the coastline; and if this coastline is such that the sea on its side throws up sand and contributes to this growth, provinces or entire kingdoms are created. Ordinarily these are the most fertile, and will soon be the richest in the world, if governments allow industry to be practiced in peace. (Rudwick, *Georges Cuvier*, 194)

Cuvier's rhetoric is not without a political ideology, for example, he states that governments should not meddle in industry. The becalmed earth is conquered and civilised. In fact, the rhetorical need to demonstrate that present causes and operations are eased or slowed and tend towards order makes major landslides "happily […] rare" (Rudwick, *Georges Cuvier*, 193), volcanoes "limited and local" (197); the "effects of the sea" are "less happy" (194). Rather than a litany of disaster, Cuvier's present causes read as a petition for peace. Since Pencati declared him "sincere" and "without any sophisms" (q.v.) after his public lectures on geology, Cuvier's declaration that "nature has changed course" from sublime terror to alluvial fertility and prosperity may read as falsely concordant. But Cuvier, did, after all, have a position to protect in a changing political and ideological environment. That said, he expresses political sentiment in regard of government involvement in industry. It would indeed be ironic if Cuvier were reconciling himself to "traditions". But he consistently defends the achievements of nascent geology and dismisses the "systems" of his predecessors:

> The necessity they have felt, to look for causes different from those we see acting today, is also that which has led them to imagine so many extraordinary suppositions, and to err and lose themselves in so many contrary ways, that-as I have said elsewhere-even the name of their science [i.e. geology] has become almost ridiculous for some prejudiced persons, who only see the systems it has hatched, and who forget the long and important series of established facts that it has made known. (Rudwick, *Georges Cuvier*, 198)

When Cuvier observes that they have looked for "causes different from those we see acting today" the question arises if not he too has done the same. In section 19, 'Former Systems of Geologists', Cuvier declares that, "For a long time, only two events-only two epochs of change in the globe-were admitted: the creation and the deluge. All the efforts of geologists strove to explain the present state by imagining a certain primitive state later modified by the deluge, the causes, action, and effects of which were also imagined by each in his own way." (Rudwick, *Georges Cuvier*, 198) How different is this from that which he himself proposes in this very essay? Does he not dedicate a

vast swathe of this text to proving the validity of the last, great catastrophe? Later, in section 23, 'Nature and Conditions of the Problem', he unifies the need for both "cabinet naturalists" and "mineralogists" in pointing up his own unique skillset. It is "the relation of the fossils to the formations" that produces a new possibility for a general theory of the earth. Biology and earth science together might begin to answer this great speculative questions of origins. But Cuvier sets "scale and limits" (203) while championing a holistic approach. His research questions (203-4) ask i) which species appear first (i.e. can they be sequenced?), ii) whether they disappear and reappear, ii) whether they are extinct, and iv) whether there is a constant relationship between fossils and climate. It is "bones alone" and skeletal structure or *charpente—the law of the correlation of parts* — that has made this all possible:

> How was it not seen that the birth of the theory of the earth is due to fossils alone; and that without them we would perhaps never have dreamt that there had been successive epochs, and a series of different operations, in the formation of the globe? (Rudwick, *Georges Cuvier*, 205)

Cuvier's boney framework or *charpente*, his fossil remains, unlock the theory of the earth. Combined with geology and a historical approach this points to a new era of nineteenth century science. The law of the correlation of parts provides an internal and integrated organic logic where nature is understood without need for ultimate or external causes. Cuvier may have been cautious of organicist approaches which led contemporaries such as Geoffroy and Lamarck toward transformism. But the *law of the correlation* represents an ultimate shift towards an organic universe and away from a mechanistic one. Cuvier presents tension between mechanism and organicism, as section 30, 'Principles of Identification', attests:

> Every organised being forms a whole, a unique and closed system, in which all the parts correspond mutually, and contribute to the same definitive action by a reciprocal reaction. None of its parts can change without the others changing too; and consequently each of them, taken separately, indicates and gives all the others. (Rudwick, *Georges Cuvier*, 217)

Geoffroyism represented a transcendental deism with God's works still realised in nature under a principle of unity. Lamarckism by contrast suggested an internal mechanism of habit and intention on the part of the organic being to trigger modification and transmutation. Cuvier's "organised beings" are based on that same principle of reciprocal unity. They are "unique" at the same time as indicative of types and species. However, the individual is the key to discovering and understanding the species, the fossils and formations, the grand narrative of earth history. Nature, in Cuvier, may at times seem an active agent but it is the interrelation of functions and parts, the assembly itself that enables the organism. It is not deistic admiration of the terror of nature that fuels the following

passage where the gruesome spectacle of Cuvier's megafauna or perhaps a lizard from his inferred age of reptiles is considered from intestine to behavioural pattern:

> Thus, as I have said elsewhere, if the intestines of an animal are organised in such a way as to digest only flesh-and fresh flesh-it is also necessary that the jaws be constructed for devouring prey; the claws, for seizing and tearing it; the teeth, for cutting and dividing its flesh; the entire system of its locomotive organs, for pursuing and catching it; its sense organs, for detecting it from afar; and it is even necessary that nature should have placed in its brain the instinct necessary for knowing how to hide itself and set traps for its victims. (Rudwick, *Georges Cuvier*, 217)

We pass from organic function to sensory perception and as far as instinct. Further, the animal exists according to "particular conditions, relative to size, species, and habitat of the prey to which the animal is adapted" (217) This is a self-sustaining organic system adapted to its environment. It is a form of survival in adaption to its environment, but with an environment that has a treacherous nature that can turn in inundation, irruptions, catastrophes. It is based along genealogical and familial lines contra to Lamarck and Geoffroy's freer movement based on a unity of plan between types. Rudwick describes it as the "animal machine". There is interconnection, synecdochal mutuality, adaption to pre-existing conditions of existence. At the same time, Cuvier's catastrophes offer indeterminacy, disconnection, incoherence. Their punctuation of existence on the planet—as in the example of mummified animal remains—do not allow time for the mechanism of transformism, transmutation, degeneration or evolution.

Cuvier's sarcastic opposition to transformism and Lamarck are beautifully summarised in Burkhardt (*Spirit of System*, 199), in a deleted note that never made publication:

> […] that the habit of chewing, for example, resulted at the end of a few centuries in giving them teeth; that the habit of walking gave them legs; ducks by dint of diving became pikes; pikes by dint of happening upon dry land changed into ducks; hens searching for their food at the water's edge, and striving not to get their thighs wet, succeeded so well in elongating their legs that they became herons or storks. Thus took form by degrees those hundred thousand diverse races, the classification of which so cruelly embarrasses the unfortunate race that habit has changed into naturalists.

The mechanism of habit is not enough for Cuvier and he cruelly mocks the transformist train that sees ducks become pikes, and so on, in turn leading to, of course, naturalists. There are multiple assertions of a "succession in nature" or various successions, but ultimately this does not suggest any single origin and transmutation of species from a single individual. Cuvier responds: "if species have changed by degrees one ought to find some traces of these gradual modifications; that one ought to find some intermediate forms between the palaeotherium and present-day species, and that up to now that has not happened at all. Why have the entrails of the earth preserved no monuments of such a curious genealogy, unless it is because the species of former times were as constant as ours, or at least because the catastrophe that destroyed them did not leave them time to give effect to their variations?" (Rudwick, *Georges Cuvier*, 226) Without a sufficient mechanism to underpin

transformist ideas Cuvier is left to read the textual evidence in the natural monuments he pieces back together into prehistoric beasts.

Summary

The *Discourse* delivers a mature narrative text consolidating not only Cuvier's science knowledge and practice, but that of his wider community encompassing Buffon and Deluc, Lamarck and Geoffroy. To some degree, Cuvier's narrative synthesises those of his peers. But in so doing produces new dynamics and unexpected effects which I briefly summarise here. First, Cuvier focuses on scientific method and approach. His disclaimer, for example, at the start of the *Discourse,* demonstrates similarities between the science discourse as text and the methodology of novelists. The effective disowning and detachment from the conclusions of the study echo narratorial strategies of novelists. Cuvier sounds like an unreliable narrator at once lending legitimacy but simultaneously questioning it through transparency of method. His "new species of antiquarian" becomes a textual adventurer espousing scientific method. This methodological alignment of naturalist and novelist extends into the narrative text and its various narrators. In the *Discourse*, Cuvier's virtual narrator descends to earth like an extraterrestrial visitor interrogating the earth. Cuvier himself conducts a textual interrogation of "traditions" in order to counter Lamarck and Geoffroy's proto-evolutionary science. Both extinction and catastrophe as mechanisms counteract science stories of modification, while the law of correlation disproves Buffonian transport stories and Lamarckian transformism based on climate change. One unexpected result of Cuvier's textual exegesis is the return of a science story incorporating Deluc's binary division of ancient and modern world, with the "thread of operations" broken "nature has changed course" (Rudwick, *Georges Cuvier*, 193). As a result, Cuvier produces a science story that invites Gothic Romance and apocalyptic spectacle; a story that seems to contradict his empirical scientific method. But in spite of this discordance between method and effect, Cuvier's law of correlation produces another "bones alone" science story and structure of proto-evolutionary science that contests legitimacy and polices boundaries against Lamarck and then Geoffroy. The *Discourse* is Cuvier's masterpiece of scientific prose. Its publication in English in Britain in the nineteenth century is where its science stories and narrative begin to interact with British science, culture and literature, as novel naturalist intersects with natural novelists.

5 First British Cuviers: Buckland and Byron

The highly structured and centralised organisation of science of the Royal Academy of Sciences in pre-Revolution France that became the National Institute in 1795 could not be further removed from the model extant in Great Britain in the same period. Conlin (*Evolution and the Victorians*, 52) describes the Royal Society established in 1660 as effectively "comatose" during the same period. The British Museum established in 1753 stood in stark contrast to the *Muséum* in Paris, the undisputed world centre of the sciences. Rudwick summarises: "the pursuit of the sciences—and indeed of practical, social, and cultural goals in general—had long been regarded not as the proper concern of the state but of individuals and voluntary organisations" (*Bursting the Limits*, 463). In 1807, the Geological Society was formed embracing Deluc's continental neologism. Several Fellows of the Royal Society were initially involved including botanist Joseph Banks (1743-1820) and chemist Humphrey Davy (1778-1829). Its research goals reflected many of its members financial interests in mining and agriculture where geological work could be of most benefit, following the British capitalist trade model. However, both Banks and Davy quickly resigned from the new body perceiving it as a threat to the Royal Society. Its geological epithet underwrote its emphasis on fieldwork and Baconian inductive, empirical science over the speculative fields of theories of the earth. Its first president George Bellas Greenough (1778-1855), widely travelled throughout Europe, toured Scotland testing *neptunist* and *vulcanist* explanations of the formations of granite and basalt. Neptunism was the standard model for the formation of primary and secondary rocks, water having deposited them in layers on the earth's surface, presupposing some form of primal ocean. Both Buffon and Deluc's theories of the earth could be defined as broadly neptunist.

But Cuvier also inherited a third dominant theory of the earth from the 1770s and 1780s from Scottish naturalist James Hutton (1726-1797). It was published in full in *Theory of the Earth* (1788), but summarised and distributed in over seven periodicals in Britain and on the continent (Rudwick, *Bursting the Limits*, 159). Hutton viewed the world as a machine teleologically adapted to the purposes of a benevolent deistic power. This world machine was in a form of steady-state equilibrium; over vast swathes of ahistorical time the earth self-regulated according to constant laws. In many ways, Hutton's theoretical model conformed to standard accounts in theories of the

earth where primary and secondary rocks were formed by subsiding waters. Like many savants he claimed that the present continents had once been on the sea floor, hence the presence of marine fossils, and that in the past there had been continents elsewhere. In this sense, Hutton's system differs little from Buffon and other common models. The neptunist contra vulcanist debate centred around the origin and classification of basalt, and perceived similarity to rocks of volcanic origin. The vulcanist position insisted on fire and internal heat as the causal agent in producing basalt. Influential "geognost" (v.i.) Werner made public his neptunist position underpinning the standard subsiding oceanic model for formation of primary and secondary rocks. Hutton, in contrast, adopted a combined vulcanist and neptunist position whereby forces of uplift were a natural safety valve regulating the world machine. He found evidence of these dual forces of elevation and erosion conducting fieldwork in Scotland and described a world, or sequence of worlds, where continents rise and then are worn down in an endless cycle. Hutton's eternalism was not that far apart from Buffon in point of fact. But his ahistorical timeless and eternal world provides a British vulcanist and eternalist theory of the earth which Cuvier's own *Preliminary Discourse* was to used to challenge. A prominent supporter of Hutton in Edinburgh was John Playfair (1749-1819), university professor of mathematics and natural philosophy. Playfair published an abbreviated and more broadly appealing update of Hutton, *Illustrations of the Huttonian Theory of the Earth* (1802). In the process of making Hutton's dense prose accessible, Playfair removed the deistic metaphysics from the original leaving a purely mechanical system of processes analogous to Newtonian physics. Robert Jameson (1774-1854) was appointed professor of natural history in 1804, soon after Playfair's new version of Hutton. He had studied under Werner at Freiburg and was an exponent of geognosy, as defined by Werner, an extension of the narrower study of mineralogy, but still based on empirical observation and so disapproving of speculative and all-encompassing theories the earth. His neptunist position brought him into direct conflict with Playfair and vulcanist followers of Hutton's theory.

Essay on the Theory of the Earth

Jameson printed Cuvier's *Preliminary Discourse* separate to its attendant material in *Fossil Quadrupeds* within twelve months of its arrival at the *Institut* on 7 December 1812 (Rudwick, *Bursting the Limits*, 511). There was no international copyright, and no way for Cuvier to impede his essay's re-publication divorced from its empirical evidence or proofs. Its swift translation by Robert Kerr, and editing and publication by Jameson, introduced yet another Cuvier to the world: Jameson's Cuvier. Jameson faithfully summarised Cuvier's research in editorial notes, but altered

the very tenor of the work in order to support his own cause in the Edinburgh neptunist-vulcanist debate. Cuvier had referred to his *Discourse* as a small part of an essay on the theory of the earth, and in so doing clarified that this was referring to a distant future where sufficient evidence may or may not have been collected. Jameson named it *Essay on the Theory of the Earth* (1813), beginning the framing for the mediation and reception of Cuvier in the anglophone world from one of its great centres of culture in Edinburgh. It was in direct contradiction to the spirit of Cuvier's work and a clear challenge to Playfair and the Edinburgh vulcanists. This was the first salvo in producing a new, British Cuvier, for local ideological struggles between rival academics in Edinburgh. The second major redirection of Cuvier's *Discourse* was in its religious realignment. Jameson's preface misdirects the reader taking Cuvier's authoritative descriptive work and lending it the moral and scriptural agenda of Deluc's Christian cosmology. He presents Cuvier as providing proofs of the deluge, which careful reading clearly demonstrates Cuvier does not. Instead, he privileges all accounts of deluges equally. Regardless, Jameson synthesises Cuvier with the goals of the broader British science community while diametrically opposing his work to Playfair's mechanistic rendering of Hutton. One important result of this blatant misdirection and misappropriation of Cuvier is the dissemination and spread of his work in a tone readily understandable to the general reader in Britain and English-speaking countries. Jameson's Cuvier went on to be published in five editions in 1813, 1815, 1817, 1822 and 1827. Even Jameson's nemesis Playfair accepted Cuvier was "defending the Mosaic chronology" (O'Connor, *The Earth on Show*, 65). Reading Rudwick's translations, in stark contrast, demonstrate that this is not the case. Nonetheless, Jameson's prefatory framing proved effective. The *Discourse* was not available in England other than in Jameson's version until a German translation appeared in 1822 in the same year as Jameson's fourth edition. *Essay on the Theory of the Earth* brought geology to many for the first time. The Irish novelist Maria Edgeworth reported in 1816 that, although Jane Austen had just sent her a complimentary copy of *Emma*, she really wanted to read Cuvier:

> we are [. . .] reading a book which delights us all, though it is on a subject which you will think little likely to be interesting to us, and on which we had little or no previous knowledge [. . . .]—Cuvier's Theory of the Earth. It is admirably written, with such perfect clearness as to be intelligible to the meanest, and satisfactory to the highest capacity. (O'Connor, *The Earth on Show*, 65)

Austen's anonymous novel from the author of *Pride and Prejudice* sold poorly in comparison to Cuvier's blockbuster. This new British Cuvier was an international bestseller, better known to the general nonspecialist British reader than in his native France.

The preface to the first edition in 1813 portrays Cuvier as a defender of Genesis and reassures the reader that the Mosaic account of creation will not be challenged. This premise is

indeed accepted even by Jameson's staunchest rival, Playfair. Translator Kerr's footnotes serve only to point up the agreement between Cuvier and biblical chronology. So, from the very first edition of Cuvier's publication in English, Cuvier is presented as a conservative and reactionary force for tradition and stability. Ironically, this may have led to Byron emphasising the radical nature of Cuvier's geology in *Cain: A Mystery* in 1821. Of course, the distancing from any charge of atheism and reconciliation with biblical tradition ensured Cuvier's success and cultural penetration in translation for two reasons: firstly, the middle-class reading public were largely religiously conservative, and, secondly, revolutionary French science was met with a great deal of mistrust after years of social and political upheaval. War with France and the allied defeat of Napoleon may have precipitated Cuvier's nationality being changed from French to German for the second edition of 1815. The third edition in 1817 includes a lengthy addition to the preface on Cosimo Alessandro Collini's (1727-1806) pterodactyle find—another in the line of new marine, avian and finally land saurians that would mark the age of reptiles first implied by Cuvier himself.[68] The third edition most importantly sees the Mosaic and Genesis references dropped, though Jameson states "the subject of the *deluge* forms a principal object of this elegant discourse" (*Essay*, ix). Jameson initially juxtaposes Cuvier and Lamarck, opposing any theory of modification "by the operation of similar causes during a long succession of ages" (*Essay,* x). In summary, this leads "naturally" (ibid.) to "our author to state the proofs of the recent population of the world; of the comparatively modern origin of its present surface; of the deluge, and the subsequent renewal of human society." (*Essay,* x-xi) Jameson's juxtaposition of the two French naturalists marks the third, possibly most important, use of Cuvier. The various proofs of extinction and renewal of the species, in other words fixity, the proofs of the deluge or catastrophes as means, the potential young-earth chronology that could be inferred, all these proofs provided by Cuvier could have successfully countered, and, if not nullified, then at least marginalised Lamarck in France. Lamarck's transformism, Desmond notes, "provided a model of relentless ascent power-driven "from below" (*The Politics of Evolution*, 4).

The fifth edition (1827) included a new 'Preface to the Fifth Edition'. Geology was confirmed as "deservedly one of the most popular and attractive of the physical sciences" where it was once "held in little estimation" and characterised by "hypotheses of boundless

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[68] Cuvier's identifications of reptilians include the pterodactyle, portrayed famously as a "flying dragon" alongside the sea-serpent *plesiosaurs* and *icthyosaurs*. His meeting with Buckland in 1818 led to the identification of the *megalosaurus* that famously appears in the opening scene of Charles Dickens' *Bleak House*. Cuvier notes in the *Discourse* that monsters are made up of parts of other animals, the fabulous being a palimpsest of nature, inscribed and re-inscribed.

extravagance" (*Essay*, v). Cuvier's authority is complete, his work containing "a complete answer" to "ignorant imputations" and demonstrating "the accuracy, extent, and importance of many of the facts and reasonings" of geology (ibid.). There is no mention of any issues of the bible or the deluge in this new preface. Instead Cuvier is equated with Britain's greatest science writers:

> In this country CUVIER was first made known as a geologist by the publication of the present essay, which, from its unexampled popularity, has made his name as familiar to us as that of the most distinguished of our own writers. (*Essay,* viii)

However, the 'Preface to the Third Edition' is then included after the new preface, building like a palimpsest. Secord (*Edinburgh Lamarckians*, 10*)* has argued for a reassessment of Jameson's public practices as portrayed in traditional accounts. Lamarck and Cuvier are given equal importance in the preface for the third edition in 1817, at the same time as the biblical references being dropped. By 1827, the new preface to the fifth edition provided what equated to "publicly advocating transmutation" (11). The trajectory of Jameson's Cuvier constitutes a transmutational curveball; the original angling as strongly providing proofs of the deluge and the Mosaic account strongly suggests a change in position from Jameson. It may also have been an expedient practice to counter Playfair and the Edinburgh vulcanists, while avoiding charges of materialism. Speculation aside, *Essay* enjoys a singular journey in terms of framing from theological reaction to social radicalism. Traditional accounts of English catastrophism and diluvialism do not include the possibility that *Essay* could be framed in terms of its original materialism, and, moreover, in alignment with Lamarckian transmutation. This reassessment means Cuvier can no longer be considered purely in opposition to Lamarck. Moreover, this gives even greater scope to the narrative significance of *Essay*, as both reactionary and radical in meaning. Cuvier's *Essay* (and it should be underlined that it is just the *Discourse* that is used) builds and grows enjoying unprecedented success and positioning him, in Jameson's words in 1827, alongside Britain's principal science writers. The very centrality of Cuvier's position as a British writer, even if claimed by a publisher, is a fact worthy of consideration. Cuvier, the British Cuvier, is never really naturalised into the British pantheon of science. He does not feature heavily in any traditional accounts of British eighteenth or nineteenth-century science. *Essay's* success and the changing prefatory material tell us more about the polemical scientific climate in Britain and about its growing book-buying consumer classes than they truly do about the man. But Cuvier was pivotal in the account of British science in the 1810-1820s and the *Essay* was well known—spread from Edinburgh and London out across the Empire.

The Reverend William Buckland (1784-1856) was the principal populariser of the new geology in Britain in the late 1810s and 1820s. As a cleric and Oxford don Buckland aimed to synthesise Cuvier and the bible. Moreover, as a member of the Anglican gentlemanly elite he was part of the ruling class bent on controlling the proper use of continental science with, as Adrian Desmond stresses, "disturbing social and political associations" (*Politics of Evolution*, 2). Rudwick (*Bursting the Limits*, 600-1) argues for a more positive approach to Buckland's donning the mantle of British Cuvier. Traditional accounts have often negatively counterposed Genesis and geology.[69] But Rudwick (601) stresses Buckland's trifold expedience in defending traditional theology, and reconciling both continental geology and homegrown eternalism such as Hutton—both of which were potentially socially explosive. The two naturalists enjoyed a long and fruitful friendship, meeting finally after long years of uncertainty and war. Oxford was under criticism from various periodicals (Topham, *Beyond the "Common Context",* 233-262) when Buckland appropriated Cuvier's association of diluvial phenomena to the "last great catastrophe" to synthesise a scriptural geology. Rudwick (601) notes that Buckland lifts Cuvier's observation that fossil elephants were found in superficial deposits and that the bones were therefore likely to have been enveloped by the last catastrophe. However, our first British Cuvier in truth followed Deluc in his binary division of ancient and modern worlds, and his yoking of it to a traditional Christian cosmology. He married Cuvier and the bible, including Cuvier's much maligned theories-of-the-earth genre, to produce a new earth science at Oxford. Cuvier's polemics against theories of the earth, however, were conveniently left out.

Buckland petitioned the Prince Regent for a readership in geology at Oxford in 1818, the same year be became a fellow at the Royal Society. His inaugural 1819 lecture, *Vindiciae Geologicae,* echoes the words of friend and scientific contemporary Cuvier. Buckland speaks of fossils as "monuments of the mighty revolutions and convulsions […] of which the most terrible catastrophes presented by the actual state of things (Earthquakes, Tempests, and Volcanos) afford only a faint image" (*Vindiciae Geologicae,* 5). At the same time he affords Cuvier the position of "one who ranks in the very first class of natural observers" (24) and invokes Cuvier's conclusion to the *Essay*, the ambition of man being "to have the glory of restoring the history of thousands of ages which preceded the existence of his race, and of thousands of animals that never were contemporaneous with his species" (6). This evidence of the great age of the globe before the last great catastrophe is easily explained by the traditional argument that a nonliteral interpretation of

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[69] G. C. Gillespie, *Genesis and Geology.*

the creation story in Genesis is compatible with both the latest scholarship and impeachable piety. Moreover, Buckland declares the evidence for a universal deluge "incontrovertible" and places it within near time, deliberately countering Huttonian eternalism with his adopted Cuvierite creed, and refuting any Lamarckian claims to transformism of species based on such generous timescales. O'Connor (*The Earth on Show*, 74) points up the irony of Buckland almost christening secular savant Cuvier as an "honorary anglican", claiming that Byron would soon make merry mischief of this in *Cain: A Mystery* (1821). But Buckland had creatively reconciled Cuvier with revealed and natural theology, effectively promoting his own career and sphere of influence. That defence included Anglican institutions under attack from radical agitators in 1819, the year of the notorious Peterloo Massacre. "Creationist politics could be fierce," according to Desmond (*Politics of Evolution*, 4), especially when faced by social activists like Richard Carlile (1790-1843) turning continental geology against their masters:

> In answer to De Luc, Dolomieu, and Cuvier, it may be observed, that nothing in geology can be more clear, than that each distinct stratum of the earth was once its surface, and that one deluge will not account for the great number of strata that are found. The succession of vegetables and animals explain the same conclusion, and all unite, with every other step in scientific researches, to overthrow that nonsense called religion. (*Republican,* 13:8, 256.)

Buckland was at the frontline in the battle over the politics of nature; each side claiming continental savants to their cause. Desmond (*Interpreting the Origin of Mammals*, 13) writes: "With science integrated into strategies designed to achieve wider social and political goals, one can appreciate Buckland's sensitivity to the Lamarckian threat of the anti-Tory radicals, who were themselves turning to nature for support." Having successfully synthesised Cuvier and conventional Anglican religion, Buckland's next triumph was at Kirkdale cave. Men working a limestone quarry at Kirkdale, in the Vale of Pickering in Yorkshire discovered remains of hyenas in a cave. Buckland rushed up to the site, writing to Cuvier 12 January 1822, insisting the importance of the find and that is should be presented to the Royal Society, not the Geological Society (*Bursting the Limits*, 626-7). The evidence suggested the fossil animals were buried there in a deluge, covered in silty deposits. Buckland believed the find could confirm the veracity of the deluge and its dating after Cuvier. He claimed that the climate of the antediluvian world was the same as the postdiluvian one as these animals were in their correct habitats, and that stalagmites untouched on the cave floor could help in dating the antediluvian world at much lower estimates than widely thought. Buckland presented his findings at three weekly meetings of the Royal Society. It marked a triumph for the Anglican elite gentlemen of science, seemingly reconciling revealed and natural theology with continental geology. While Cuvier was exercising authority and providing boundaries for the proper

use of science in France, his work was providing legitimacy for similar boundary work for British elites in the 1820s. O'Connor (*The Earth on Show,* 89) writes that Buckland's descriptions of the Kirkdale cave and its environment "laid claim to a narrative domain traditionally governed by Genesis and Paradise Lost". In his advocating the primacy of fossils in such acts of reconstruction, he became the primary exponent of Cuvier's research agenda in Britain. However, Buckland used Cuvier's research agenda for his own local purposes. Both were part of elites struggling to manage the reception of a new understanding of nature, or at least new evidence precipitating new understandings. Both were in opposition to eternalist and transformist accounts of earth history that could underpin radical agendas in science, religion and politics.

Reliquiae Diluvianae (1823) sold well after the Kirkdale finds and marked the fulfilment of Buckland's dovetailing of sacred history and the new geology. In addition to the mammalian fauna of a possible antediluvian environment, Buckland and Cuvier also collaborated on some of the great saurian finds of the 1820s, and, more importantly, their naming and correct identification. Buckland came into possession of further finds that Cuvier identified as belonging to a giant lizard on a visit after the end of the war and Bourbon Restoration in 1818. Buckland and fellow clergyman-geologist William Conybeare (1787-1857) worked on a paper on the newly named "giant lizard" or megalosaurus*,* for inclusion in a new edition of Cuvier's *Fossil Quadrupeds*. The descriptions and drawings of the bones were published in the *Transactions of the Geological Society* in 1824. *Megalosaurus* was the first of the land saurians, the triune later used by Richard Owen to name the *dinosauria*. O'Connor's casting of Buckland as the "pre-eminent British advocate of Cuvier's vision of geology" (*The Earth on Show,* 74) reflects Buckland's use of Cuvier to project his own vision of geology subordinate to—and at times perhaps superordinate to—scripture. Buckland's embracing of Cuvier produced unpredictable literary results in Byron's lampooning of this newfound coziness between Anglican gentlemanly elites and a French naturalist claimed by atheists and materialists alike in post-revolutionary France. Buckland creeping into the Hyaenas' Den in 1822 may have marked a watershed in pictorial representations and physical reconstructions of antediluvian habitats, but his work is consistently based on the authority of arch-reconstructionist Cuvier.

Cain: A Mystery

I have argued for and demonstrated Cuvier's centrality in British science in the 1810s to 1820s. *Essay* was used to support diametrically opposed science stories: neptunist and vulcanist, diluvialist and Lamarckian. This expedient use of Cuvier was met with skepticism by Byron in his

controversial verse-drama *Cain: A Mystery* (1821).[70] Byron's first use of Cuvier comes then in the prefatory note to *Cain* (1821):

> Note. The reader will perceive that the author has partly adopted in this poem the notion of Cuvier, that the world had been destroyed several times before the creation of man. This speculation, derived from the different strata and the bones of enormous and unknown animals found in them, is not contrary to the Mosaic account, but rather confirms it ; as no human bones have yet been discovered in those strata, although those of many known animals are found near the remains of the unknown. The assertion of Lucifer, that the pre-adamite world was also peopled by rational beings much more intelligent than man, and proportionably powerful to the mammoth, &c. &c. is, of course, a poetical fiction to help him to make out his case. (*Cain,* Preface*,* viii*)*

Byron seems confident that his enlightened reader, familiar with periodicals, will "perceive" that Cuvier is "partly adopted" (viii). This may be somewhat tongue-in-cheek; indeed, O'Connor (*The Earth on Show*, 103) describes the preface as "mischievously pious". However, *Essay on the Theory of the Earth* was in its third edition by 1817, and, moreover, Cuvier had received broad press and coverage in reviews and periodicals. Of course, Byron was responsible for much greater notoriety as a result of *Cain*. Byron's friend, the Irish poet Tom Moore lamented his use of potential "desolating" geology "in poetry which every one reads" (102-3). Byron wrote to Thomas Moore in a letter from Ravenna on September 19th, 1821 (*Byron's Letters and Journals* VII. 215-216) explaining that Lucifer shows Cain "phantoms of a former world" in "Hades". Byron says: "I have gone upon the notion of Cuvier, that the world has been destroyed three or four times, and was inhabited by mammoths, behemoths, and what not; but *not* by man till the Mosaic period, as , indeed, it proved by the strata of bones found;—those of all unknown animals, and known, being dug out, but none of mankind." (VII. 215-216) *Cain* then marks a significant step for Cuvier into literary works and productions. It places him at the centre of British literary narrative, in a verse-drama that reconfigures the biblical account. Moreover, Cuvier's geology acts as a "claim to historicity" for Byron (Watt, *History of the Novel*, 386), but combined with a self-declared "poetical fiction" (*Cain,* Preface*,* viii*).*

In Act II Scene i of *Cain: A Mystery,* Lucifer takes Cain on a cosmic voyage into "the Abyss of Space" to "shew to thee things which have died" (*Cain*, 217). Lucifer leads Cain "To what was before thee! The phantasm of the world; of which thy world Is but the wreck." (221) Lucifer tells Cain that, "mightier things have been extinct" (221) and shows him "mighty phantoms" (239), "past

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[70] An anonymous article under the pseudonym Zephyrus, in The Republican on February 11th 1825, 'More Learning!', explains Byron's favouring of Cuvier, alongside Boyle and Voltaire: "Boyle, Voltaire, and Cuvier were favorites with his Lordship. That Boyle who "stamped," as D'Israli says, "originality upon a folio;" that Voltaire whose magic pen turned faith into reason, hatred into love, and narrow minded bigotry into the purest and sweetest philanthropy; and that Cuvier who hath re-engraved and illumined the illegible tablets of time, whose characters had been erased and darkened by the destructive hand and cimmerian gloom of oblivion". (*Republican* 11.6, 163)

leviathans" (277) and "Mighty pre-adamites" (310). They are inhabitants of former worlds on earth. Lucifer (241) tells Cain:

> By a most crushing and inexorable
> Destruction and disorder of the elements,
> Which struck a world to chaos, as a chaos
> Subsiding has struck out a world : such things,
> Though rare in time, are frequent in eternity.
> Pass on, and gaze upon the past.

This image of worlds destroyed and made again out of chaos, set against the citing of Cuvier, implies mechanisms of extinction and survival without recourse to religious metaphor. Moreover, the successions of worlds and variations in nature in *Cain* present a vision of earth history through Cuvier. He continues (254) "The mammoth is in thy world: but these lie/By myriads underneath its surface." The fossil remains of mammoths found in our world allude to the Peale Mammoth. O'Connor (*The Earth on Show*, 31-69) demonstrates how the Peale Mammoth penetrated into contemporary culture including references to "Bonypart" (35). The connection of Napoleon and a fossil reconstruction invites various interpretations, especially in the light of the radical associations of French science in Britain in the period. The Peale Mammoth, the first complete fossil reconstruction that set sail for Britain in 1802, is the first great reconstruction and popularisation (or projection and reception) of Cuvier's work and theory of catastrophic extinction onto the world stage. It is a physical performance of Cuvier played out to the hearts and minds of a broader audience. The English-speaking audience may have first learnt of catastrophic extinction through Rembrandt Peale's *Historical Disquisition on the Mammoth* (1803).[71] The mammoth represents the first performative reconstruction of former worlds.[72] It comes to signify Cuvier's theory of catastrophic extinction and features heavily in Byron (*Cain*, *The Deformed Transformed*, *Don Juan* etc).[73] One might imagine the Peale Mammoth alongside Mary Shelley's Frankenstein as respective giant and beast of the antediluvian earth. O'Connor (*The Earth on Show*, 104) points out that many failed to appreciate the subtleties of Byron's depiction of Lucifer:

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[71] See O'Connor, *The Earth on Show*, 31-34.

[72] Rembrandt Peale's presentation of the mammoth as carnivorous plays to spectacle and the terrible purpose that creates the sublime. The monster is "of nature" and yet "terrible". It is a meeting with danger up close, and yet safely held at bay. Peale, in a clear functional mode of storytelling, seeks to oppose Cuvier in declaring (if on little authority) "the Mammoth was exclusively carnivorous", *Historical Disquisition on the Mammoth, 48.*

[73] Mary Shelley read *Don Juan* (Cantos I and II, 1819) in 1820 (*Journals* I. 345.). She copied Cantos XI to XVI of the poem at Albaro (*Journals* II. 432.). Her knowledge of these poems would have been that of an amanuensis. It is fair to assume, considering her knowledge of Buffon and having written descriptive prose featuring Mont Blanc, that she would then have been familiar with Cuvier's Doctrine de Révolutions; if not first hand, then vicariously. She writes to Jane Williams from Genoa Oct 15th, 1822, telling her she has copied both Cantos of *Don Juan.*

> By demonizing the new science as a gift from Lucifer, Byron confronted the imaginative challenge it posed to biblical literalism. If you base your faith on the literal truth of Genesis, he seemed to suggest, modern science will wreck it for you.

O'Connor continues that, "Cain spurred radicals in Carlile's circle to start wielding Cuvier's historical geology as a weapon against the Church (for instance in Carlile's newspaper The Republican), rather than relying solely on the increasingly outdated eternalist cosmologies of Hutton, Toulmin, and Palmer." (104) Carlile published a cheap pirate edition of *Cain* making it widely available to a broader and poorer public. *Cain* and *The Republican* radicalised Cuvier.

O'Connor (*The Earth on Show,* 108) discusses Reverend William Buckland's verse response to Byron's *Cain* in which, it is claimed, he sides with the radical-materialist front against Byron.[74] Buckland's positioning in the broader polemic demonstrates various cogent points relevant to our study: first, it shows the significance of both geology in verse, and Cuvier's entanglement in these dramas; second, it demonstrates the rhetoric surrounding *Cain* could and would not have escaped Mary Shelley,[75] nor probably our later authors, Eliot and Dickens; and, third, it shows the level of cultural penetration of Cuvier's ideas, into Georgian and Victorian political, theological, geological and poetical debate. O'Connor (108-9) examines Buckland's response in *The Professor's Descent*. The Professor "enters the cave and, on speaking the magic words ("the verse that vocalizes stone"), has a vision of the antediluvian world or "Lord Byron's Hell & Chaos". Lucifer appears and, thinking his visitor an ally, reveals that he is brewing a poisoned drink to drive radical science writers into further acts of madness:

> A drink to madden Byron's brain,
> To nonsense madder still than Cain;
> To fire mad Shelly's impious pride
> To final crisis, suicide.
> This quaff'd in vulgar Carlisle's alehouse
> Shall quickly urge him to the gallows.[76]

Reverend William Buckland demonstrates the effect of *Cain* on British geology; its threat to the hard-won respectability for which he had fought. Geology, and in particular Cuvier — perhaps all

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[74] See also Rupke, *The Great Chain of History.*

[75] Mary Shelley remarks "read Cain" on Thursday November 1st, 1821, in her journal. Mary wrote to Mrs. Gisbourne: "To me it sounds like revelation—of some works one says—one has thought of such things though one could not have expressed it so well—It is not this with Cain—one has perhaps stood on the extreme verge of such ideas and from the midst of darkness which has surrounded us the voice of the Poet now is heard telling a wondrous tale" (*Letters* I. 212.). She writes to Maria Gisbourne from Pisa on November 30th 1821: "You will be both surprised and delighted at the work just about to be published by him.—his Cain—which is in the highest style of imaginative Poetry. It made a great impression on me, and appears almost a revelation from its power and beauty" (*Letters*, I. 209).

[76] Full text in O'Connor *The Earth on Show*, 109.

things French — was being radicalised in materialist attacks on the clergy and the establishment. At the centre of these attacks stood political agitator Richard Carlile (1790-1843).

Carlile, in 'Philosophy of a Newspaper', claims that, "English newspapers form the lowest part of the literary commerce of this country" (*Republican* 13:8, 255). Carlile derides *The Representative* for contradicting itself on the subject of "the strata of the earth and its animals" (*Republican* 13:8, 256). He demonstrates how geology and Cuvier are to become part of his materialist manifesto and a stick with which to beat the clerisy. On the deluge, he states the belief of, according to "De Luc, Dolomieu, and Cuvier", "catastrophe having buried all countries that were previously inhabited by man and other animals" in a reciprocal exchange of land and water. Moreover, that a "series of livings of forms" and their extinction is proved in the fossil record. And thirdly, "Revolutions in the Animal Kingdom" had occurred, and that a mutual fitness existed between earth and its inhabitants. Carlile concludes:

> In answer to De Luc, Dolomieu, and Cuvier, it may be observed, that nothing in geology can be more clear, than that each distinct stratum of the earth was once its surface, and that one deluge will not account for the great number of strata that are found. The succession of vegetables and animals explain the same conclusion, and all unite, with every other step in scientific researches, to overthrow that nonsense called religion. (*Republican* 13:8, 256.)

Geology then disproves religion and supports Carlile's materialist cause. In a letter to the editor, February 1st 1822, satirising the clerisy entitled 'On prejudice and Black-Gothism', signed REGULATOR, one writer summarises the men, Cuvier among them, that have contributed to "only the morning of science" (*Republican* 5:5, 141.): "These are the men who have overturned Bible Astronomy and Bible Geology, and who have added myriad of worlds we inhabit. The tithe-eating Goths should persecute the diurnal motion of the earth upon its own axis, for this globe falsifies the Bible, this earth is the blasphemer, and not Mr. Carlile." By this token, Cuvier's doctrine of revolutions might be implicated in plots of politic radicalism in 1820s Britain. It certainly would be linked to social unrest and instability.

Byron and *Cain* feature widely in geological writings. O'Connor (*The Earth on Show,* 352) notes that citing Byron became symbolic of "the sublime"; in short, geological science writers used Byron and *Cain* to imply the connection between their scientific pursuit of "rational amusement" and Byron's verse's power of imagination that could better approach such speculative mysteries, traditionally the department of poetry and metaphysics. This widespread use of Byron's verse continued to confront the strangeness of prehistoric worlds and thereby mediate Cuvier. Was Byron's "Hades" an analogue for Cuvier's pre-adamite worlds? *Cain* epitomises the draw of geology in a "rhetoric of spectacular display" (Secord, *Victorian Sensation*, 439) that uses "a

common experience of science". The combination of factual and fictional elements subverts "traditional generic taxonomies" (Watt, *Theory of the Novel,* 385) confusing the reader by pointing up the narrative's instability. Through *Cain*, Cuvier penetrates British literature from a position of centrality. But from diverse and multiple centres from within British culture, at once representing reaction and radicalism alike.

Summary

We have charted, in brief terms, Cuvier's success as "pragmatician" in manoeuvring himself to and maintaining his position the centre of world science in Republican, Imperial and then Restoration France. But from the publication of *Essay* in 1813 and onward, Cuvier became central to both British science, literature and culture. The first "British Cuviers" were then Jameson's text and Reverend William Buckland. But Cuvier was also propelled to the centre of British literary expression when Byron dramatised this scientific and ideological struggle in *Cain: A Mystery*. Science and literature combined in what Secord has termed a "rhetoric of spectacular display" (*Victorian Sensation*, 439). Secord (*Edinburgh Lamarckians*) has also shown that Jameson's *Essay* shifted its political and ideological goals from countering to aligning with Lamarckian science. Jameson's *Essay* created Cuvier, the great British writer, from the cultural centre of Edinburgh, while Buckland synthesised Cuvierite geology to chart a diluvialist middle course through regency Britain from London. Both were battling greater forces of radical and social upheaval on a broad scale, but also engaging local practitioners in competing for science authority. First of these threats was Huttonian eternalism, a homegrown theory of the earth, expanding the continental Buffonian model. Second among those threats was Lamarckian transformism, thriving on extended earth histories, and employed by radical activists and even universities and hospitals in Edinburgh and London by the 1820s (Desmond, *Politics of Evolution*). Third, and a result of all of these, was the destabilising of scriptural authority and, as a result, social cohesion. In countering all these very real, physical threats of the 1810s and 1820s, and perhaps even in supporting them, Cuvier's proofs of extinction and deluge, of fixity of the species, and of a historically limited earth were central to the story of British palaeontology, geology, and science.

6 The Last Man

Contrasting “systems” or theories of the earth all present a nature either glowing with God’s beauty and providence, or full of the deistic essence of life; either way we are beholding a world in harmony. Even Cuvier’s comparative anatomy that impelled these early forays into the uncharted worlds of geology were based on an internal unity, a correlation of parts, as he termed it: for the anatomist, the world was perfect on the inside. Lamarck found the human world problematic as, on evidence, it did not agree with a beautiful and wondrous nature ever growing in complexity toward perfection. He was committed to explaining all physical objects as products of nature, depriving humans of any divine spark in the process. (Jordanova, *Lamarck*, 89) Instead, political philosophies like Thomas Hobbes’ (1588-1697) *Leviathan* (1668) proposing “the war of all against all” might seem more appropriate, born as it was of the context of the English Civil War. Sterrenburg notes the characters in *The Last Man* “try to enact various reforming and revolutionary solutions, but all such endeavours prove to be a failure” (“Anatomy of Failed Revolutions”, 328). Combine Hobbes with the bleak catastrophe of Thomas Robert Malthus (1766-1834) in *An Essay on the Principle of Population* (1798) and you may get a better picture of the human world.[77] “Science was knowledge of nature gained by the human mind,” Jordanova writes (84). The novel is a similar project. Watt claims it represents the knowledge gained by “particular individuals having particular experiences at particular times and at particular places” (*Rise of the Novel*, 31). In this sense, novels always amass knowledge of nature and knowledge of human minds, and the science that bridges the two. This rather syllogistic argument promises much, revealing little. But science is a contested space, for novelist and naturalist, for scientist and literary scholar alike. *The Last Man* struggles to make sense of the natural and the human world; at once, engaging human history from the idealistic hope of the French Revolution to the hero-worship of glorious empire, to dissolution. While at the same time, interrogating earth history, through narrative strategies that question our cosmology. However, Bailes ("The Psychologization of Geological Catastrophe"*)* argues that Shelley shifts “geological catastrophism into the psychological “world” of the individual” (672). It is this thoroughgoing emphasis on individuals that connects Cuvier and Mary Shelley in both method and story. Individualism combined with interrogation of both scientific and literary knowledge and practice.

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[77] In 1805, de Grainville in *Le Dernier Homme* (translated to English in 1806 as *Omegarus and Syderia, a Romance in Futurity*) uses Malthusian sterility to initiate an extinction narrative. Ormus, the spirit of the earth, can no longer support the human race, which slowly dies out — Omegarus becoming the last man in search of Syderia, the last woman.

One clear result of attempting to combine a historicist and aesthetic approach to literature and science is that the novel is approached from "thick" context. It exists in a time and a place; though critics everywhere and "everywhen" will immediately point to the kaleidoscopic multiplicity of times and places any novel might inhabit. It is, indeed, inhabiting *this* narrative as it is written, saved onto various cloud servers, transferred into varying file formats, emailed to proofers and readers, printed, deleted and even discarded. But one single context is "static," and that is the context of the novel itself. The world of the novel, its "knowledge of nature gained by the human mind" (Jordanova, 84) always occurs in the same time and place. There were four editions of *The Last Man* published between 1826 and 1833. But the basic text and textual world have remained constant. (*The Last Man*, xi) The question I am addressing is that of textual meaning and its location. Mary Shelley had a very clear textual meaning in mind: "the lovely and sublime objects of nature have been my best inspirers & wanting these I am lost" she writes (*Journals*, II, 476). Her "science" in *The Last Man* is clear, her place in nature lost. But much can be said of *The Last Man* without the specific textual meaning of Mary Shelley, 1824-1826, after the death of Percy.[78] This is not to detract from biographical critics whose job it is to find Percy and Mary in its pages.[79] Nor is it to say that a contextualist approach happily divorces work from author or even implied subject.

The year is 1818. The narrator discovers fragments of a narrative on bits of leaves and bark in a cave, supposedly the Sybil's cave, near Naples. They are written in ancient and modern scripts. The narrator confesses to piecing back together the fragments creatively. They reveal a story set in the future, but recovered from the past. In the story, the first-person narrator, Lionel Verney, witnesses the slow decline of the human race due to disease, and a world thrown into disorder and chaos. He finally becomes the last man and writes a book to the dead in Rome, his monument to a foregone race. In the final scene, Verney decides to set out in his tiny boat to wander "the shores of the deserted earth" (*The Last Man,* 365) in the vain hope of finding another survivor. His intended course will take him past Naples. The book is the narrative discovered initially in the frame in 1818. The book written by the last man is set somewhere around 2073. Shelley combines various genre formats or styles. Sterrenburg ("Anatomy of Failed Revolutions") writes of its variety of genre:

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[78] *The Last Man* was written between February 1824 and November 1825 (*Letters* I. 431). It was a literal process of dealing with her feelings after Shelley's death aboard the *Don Juan* in 1822, and Byron's illness and death in April 1824. She seems to have started writing *The Last Man* in conjunction with Byron's illness, but her journals and letters do not make this clear. She refers to it as "my Sibylline Leaves" (*Letters*, I. 508.) in a letter to John Howard Payne; Coleridge refers himself in the Preface of said work to his "fragmentary and widely scattered" works.

[79] See Dean, *Mary Shelley and Gideon Mantell,* for an example of biographical work that ties Mary Shelley to Gideon Mantell in the 1820s. This can easily lead to further studies looking to tie Mantell's geology to the Shelleys. Gideon Mantell is sadly barely mentioned in this study, an omission due to constraints of scope.

"Her novel is intellectually ambitious. Formally, it combines confession and anatomy. In part, the novel is an anatomy or encyclopedic survey of a number of political positions, including utopianism, Bonapartism, and revolutionary enthusiasms of various kinds. *The Last Man* deals with politics, but ultimately it is an antipolitical novel" (328). The frame combines travel writing, epistolary writing, and has connections to scientific fieldwork as practice and discourse. This multiplicity of forms self-reflexively interrogates the romance as genre producing a multivalent novel form. Sterrenburg's "antipolitical" political novel also plays out science stories as geological revolutionary drama. Plague is the agency by which humankind is slowly removed from the earth. Bailes claims "Shelley charts the disease's movement across the earth in an atmosphere of geological intensity" ("The Psychologization of Geological Catastrophe", 683). Plague could be yet another legitimate science story, like Buffonian migration in a cooling earth narrative.[80] Neither a Hobbesian "war of all against all" nor a Malthusian catastrophe account for the downfall of the human race. In fact, geo-disaster is visited specifically on human and individual worlds. Volume I charts the historical background to the plague. Volume II navigates the decline of humans, played out against the endurance of the natural world. Volume III follows the last fellowship from Britain in their search for sanctuary in warmer climes and eventual reduction to the last man. Verney, last of his fellowship in Rome, sails off in search of survivors and confirmation that he truly is the last man. The only question left: is it survival or extinction? The novel as meta-structure has centripetally circled in from natural world, to human world, to the individual.

The various interrelationships of the characters in the book are not my primary concern in this reading. It is enough to consider the individual as protagonist in the narrative and the science stories projected. The mode of autobiographical memoir asserts "the primacy of individual experience" (Watt, *Rise of the Novel*, 15). However, some broader themes are of importance in understanding that science. The book loosely mirrors the progress of Europe from French Revolution, the Republic, and the First Empire, to Napoleon as warrior-hero, to then, at the height of his courage and nobility, to sudden catastrophe, then slow revolution and degradation of humankind through the agency of plague. This particular human, historical grand narrative plays out against an ontological grand narrative of "man's place in nature". This particular knowledge of nature in the book interrogates the same contested space of science we have examined thus far. *The*

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[80] Shelley had read Buffon's *Théorie de la terre* included in *Histoire naturelle* (1749). Buffon's idea of a cooling earth a "sublime but gloomy theory" (*PBS Letters* I. 495-502) seemed more plausible to the Shelleys than Saussure's interpretation of advance and recession. This bleak doom awaiting the earth permeates the power of Percy's poetry in *Mont Blanc* and Mary's descriptions in *Frankenstein*. Much of it persists in the "degradation" evident in *The Last Man*. It also demonstrates Mary Shelley's familiarity with theories of the earth and natural history. Buffon appears in Mary Shelley's reading for 1817 after this journey.

Last Man is particularly conducive to historiographical analysis, due to its overarching historical narrative matching that of the long nineteenth century and Georges Cuvier. In the previous chapter, interactions with Cuvier in Britain from 1813 to 1827 were charted as part of the contested space of science on a localised level, and further as part of the politics of science on a broader ideological level. These were then traced into the literary work of Byron. Cuvier's proofs of extinction and catastrophe were used to counter British theory of an eternal world machine, both deistic and purely mechanical, where the earth and nature were in a steady, ahistorical state. Similarly, these same proofs were deployed to suppress the perceived threat of Lamarckian transformism, where, by inference, people could change their position in society and the chain of being through will and habit. Finally, Cuvier was synthesised with scriptural accounts of earth history in order to legitimise an already besieged religious elite. I will assess how these debates that constitute the practice of science in Britain inhabit the same spaces interrogated by the novel. The novel, as a form, and through its protagonist, asks the same question: how do I make a space for myself?

The introduction to *The Last Man* begins as a piece of travel writing as the narrator and companion cross the Bay of Naples to visit "the antiquities which are scattered on the shores of Baiae" (*The Last Man*, 5), itself a deserted ruin of a city. The two companions leave their guide in search of antiquities. At first, however, the only sign of life is "the perfect snow-white skeleton of a goat" (5). The party have entered into a scene of natural rather human history: "Ages had elapsed since this catastrophe; and the ruin it had made above, had been repaired by the growth of vegetation during many hundred summers." The Bay is of course the site of the eruption of Vesuvius and the destruction of Pompeii in 79 AD, convulsed by the forces of vulcanism; but those volcanic forces of catastrophe were part of a cycle in which nature is clearly renewed.[81] The contention that there may be any supernatural reading of the cave is quickly dismissed: "the whole of this land had been so convulsed by earthquake and volcano, that the change was not wonderful, though the traces of ruin were effaced by time" (7). The mythical is de-mythologised, ready to be read as human and natural history alike. The cave is strewn with "furniture" consisting of "piles of leaves, fragments of bark, and a filmy white substance, resembling the inner part of the green hood which shelters the grain of the unripe Indian corn". Is this some residue of volcanic ash? Then "traditions" of the mythical resurface: "This is the Sybil's cave; these are Sibylline leaves". The fragments are "traced with characters" some "old as the Pyramids" (7). However, some are written in modern dialects and describe modern events as well as ancient prophecies.

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[81] See Heringman, *The Style of Natural Catastrophes*, for accounts of vulcanist catastrophes in nature, including Vesuvius.

They make off with their "treasure" and then return to their find, collecting more fragments and scraps. Now, this may imply the supernatural in the parchments. But the narrator soon attests to a critical textual approach in reassembling narrative from fragmentary evidence: "Scattered and unconnected as they were, I have been obliged to add links, and model the work into a consistent form." The narrator expresses the wish to believe, despite "the English dress of the Latin poet" (8). Michael McKeon addresses questions of truth and narrative instability in *Generic Transformation and Social Change: Rethinking the Rise of the Novel* (1985). The question of narrative being constructed and reconstructed informs the frame.[82] One of the cultural modes or movements McKeon describes as contributing to "naive empiricism" in championing "true history" is the scientific revolution (*Theory of the Novel*, 385). Shelley's narrator does claim historicity, but the reader detects a note of skepticism. Shelley seems to play on the claims of authors such as Defoe and Richardson who "pretend to be only the editors of authentic documents whose plain and artless truth is above question" (386). Instead, Shelley implies self-parody as found in Swift and Fielding. McKeon explains that this is how "naive empiricism generates its own, radically skeptical, critique" (386). But as the reader can already guess from the title, "Truth is always strange—Stranger than fiction" (*Don Juan* XIV. 101). The fact-fiction tension of *The Last Man* however is never really resolved.

The frame sets up an accidental archaeological find of contradictory nature. These "monuments" discovered in a cave unlock a narrative "unintelligible in their pristine condition" (*The Last Man*, 8) and therefore interpreted by human understanding and context. These "monuments" prove to be those "of a foregone race" (310) that make up the main narrative. But the frame initiates the broader scientific or epistemological question of how to read and critically interrogate the past and its sources. Bailes links Cuvier's antiquarian project to her 1818 novel, *Frankenstein,* coincidentally the year of the frame: "Shelley's reconstruction of Sibylline prophecies represents an act analogous to that at the center of her first and more famous novel, which some paleontologists viewed as a horrifying correlative to their work." ("The Psychologization of Geological Catastrophe", 683) This past, or future, we are about to be presented with is knowingly mediated, a conspiracy in which the reader is complicit. The reader is, however, presented with

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[82] Sterrenburg ("Anatomy of Failed Revolutions") understands *The Last Man* to be a new kind of confessional: "In The Last Man Mary Shelley leaves behind the domestic gothicism of Frankenstein and invents a new confessional format. On the one side, she greatly expands the demonic threat, changing it into a disembodied, all-pervasive, mindless onslaught. On the other, she narrows and diminishes the role of the narrator, who emerges as a largely passive observer of political and natural disasters. The narrator writes in total isolation and frequently despairs of ever finding a readership." In this sense, the confessional moves *The Last Man* away from Romance and the "gothicism" of the 1818 Frankenstein.

differing types of proofs with formal similarity to Buffon's division of facts, monuments and traditions in describing the natural world. The facts are the observable details of what, we are told, we see: the present. The monuments are the antiquities of nature, that tell us the story of the past, and the traditions are the human stories, both oral and written: the sum of human collective experience. Together these may unlock the theory of the earth in *The Last Man*. There is no such genre as science fiction in 1818 when the text is reassembled. Sterrenburg notes: "The structure of her novel, with its isolated narrator-witness who is surrounded by disasters and holocausts, looks forward to such works as H. G. Wells's Time Machine and War of the Worlds. " (*Anatomy of Failed Revolutions,* 347) The text then covers the period 2073 when the republic is instituted and Verney, the last man and protagonist, is but a boy; the story as told by the "narrator-witness" runs through roughly 2092 to 2100. Read at face value, it loops back to antiquity and presumably continues *ad infinitum*. This feeling is expressed much later on in the narrative by Verney, as:

> [...] a feeling experienced by all, understood by none—a feeling, as if in some state, less visionary than a dream, in some past real existence, I had seen all I saw, with precisely the same feelings as I now beheld them—as if all my sensations were a duplex mirror of a former revelation. (*The Last Man*, 283)

Eternalist theories of the earth were indeed common in 1818, and Hutton's would have been best known in the Britain of this period. We have already seen the use of Cuvierite proofs to try and suppress Huttonian eternalism in both London and Edinburgh, the two great cultural centres of nineteenth-century Britain. This cosmological context is introduced in the frame narrative, where Shelley seems to vacillate between naive and skeptical empiricism and so destabilises truth claims, and any historicity. The main narrative alone could be just a wild romance; a tale told in a far-off future, resonant of the near-gone past. However, as Sterrenburg points out, its confessional narrator-witness, and anatomy of failed revolutionary endeavours, demonstrates its formal instability, its privileging of individual experience, and its production of new plots—even when recycling old ones. The frame, moreover, destabilises any linear or simple, directional time. Without recourse to a theological model of time and earth history, the novel is left with dominant theories of the earth. The setting is redolent with the antiquities of the ancient world, but knowledge of nature in 1818 places Jameson's Cuvier and Hutton as the main competing theories of earth in Britain. By 1818, according to Secord, these two supposedly opposing models may well have been realigned by Jameson in the third edition of *Essay*. *The Last Man* repeatedly interrogates knowledge of nature in 1818 and on in time. Just like Sterrenburg's proposed anatomy of failed political revolutionary models, *The Last Man* also interrogates geological and proto-evolutionary ones. Shelley drives an investigation of proofs: facts, monuments and traditions; a meditation that, to some degree, makes

the novel itself a putative theory of the earth. Cosmological angst interrogates Newtonian celestial mechanics. *The Last Man* asks "Will the earth still keep her place among the planets? will she still journey with marked regularity around the sun" (320). Lionel Verney's speech zooms in from universe to planet, through flora and fauna, rushing centripetally inwards; and yet man, "paragon of animals" fades (320). This appears toward the end of the last fellowship of humans on earth. Protagonist Verney confronts an eternalist theory of the earth. He challenges the universe to intervene by some agency, natural or divine. But as the narrative draws inevitably toward the last human, facing extinction, it seems that a purely mechanical eternalism may destroy humanity. The vanity of the individual is then to question a scheme of the universe where even a Newtonian celestial mechanics might derail without humans and the human mind to know it. *The Last Man*, I suggest, vainly searches for proofs of providence or, at least, of a benign universe. But this search is cloaked in a skeptical critique of the novel's pseudo-historical naive empiricism.

Anatomy of Earth Science

After the crypto-biographical politico-historical panorama of Volume I, Volume II presents us with observations, "facts," a litany of incidents whose natural history require a natural philosophy to explain their significance. Some, as in the case of the well-meaning savant Merrival really are theories of the earth; others are just celestial or terrestrial signs or events that interrogate causes. The "black sun" incident in Vol. II (*The Last Man*, 177), at first, seemingly describing a total solar eclipse, takes on supernatural tones. Indeed, Lionel declares that "little credit would have been given" the "strange story" had there not been "a multitude of witnesses, in various parts of the world". (177) As "Night fell upon every country" we know that this is not a total solar eclipse as that would only be visible from highly limited areas of the earth when it does, very rarely, occur. The wave of human dread created by the "sun of darkness" (178), "unknown shapes figured on the ground" (177), is, however, genuine. Earlier in the same chapter the speculative natural philosophy of the kindly astronomer, Merrival—"learned as La Place" (225)—becomes prophecy of "earth become a paradise" and "an earthly hell or purgatory" (174). Merrival's "earthly paradise" is based on an "ingenious essay" by Mackey where "pericyclical motion of the earth's pole (and thus of the ecliptic), not the wickedness of mankind, was the source of all myths of decline" (174). The shift in primary cause, however, does not seem to alter the end result, as Merrival confesses that, "an earthly hell or purgatory, would occur, when the ecliptic and equator would be at right angles" (174). Merrival's well-meaning natural philosophy, bound up in myth, preserves a religious end-time with both an earthly paradise and hell envisaged. It is mocked by Ryland, leader of the

popular democratic party, who pithily states: “Be assured that earth is not, nor ever can be heaven, while the seeds of hell are natives of her soil” (173). It is not a wholesale theory of the earth in that it foes not explain all of the earth’s workings. Merrival’s natural philosophy presents an extended age of the earth; but it is unclear whether slow revolutions make this an eternalist model. It is not, however, aligned to the British natural theology of the anglican ruling elite. In that sense, Merrival’s natural philosophy is the opposite of his ineffectual and bumbling good nature. On the contrary, it opens doors to materialism and atheism, to reform and revolution. Science discourse inhabits the narrative of *The Last Man* and Merrival’s speculative theory provides one example of the competing earth theories present in the text. Watt (*Rise of the Novel*, 14) argues that the novel needs new representations of nature. *The Last Man* provides an anatomy of earth theories challenging to best describe the new nature as it unfolds.

The journey of the last fellowship of humans in England—and then, apparently, in the world—in search of some sanctuary drives the narrative to its end. When the English entourage arrive at Dover, nature is in uproar in a “tremendous war of air and water” (*The Last Man,* 287). Bailes links this to Buckland’s diluvialism claiming Shelley “rejects the biblically and geologically founded deluge of the past as a possibility for the future destruction of humanity” ("The Psychologization of Geological Catastrophe", 683). At the start of Volume III, Lionel Verney had mocked—in self-deprecation—the very absence of conventional apocalyptic signs in nature:

> Hear you not the rushing sound of the coming tempest? Do you not behold the clouds open, and destruction lurid and dire pour down on the blasted earth? See you not the thunderbolt fall, and are deafened by the shout of heaven that follows its descent? Feel you not the earth quake and open with agonising groans, while the air is pregnant with shrieks and wailings, - all announcing the last days of man? No! none of these things accompanied our fall! (247)

Lionel goes on to describe a pastoral idyll of the garden of England in spring. The juxtaposition of pastoral idyll and apocalyptic catastrophe reinforce the instability of the framed narrative. Its historicity is continuously undermined and destabilised, just as the reader’s reception of the reliability of any human narrative, and this particular account, become increasingly skeptical.

At Dover, as the rearguard of English survivors prepares to leave for Paris, there is grave turbulence in the natural world. The “tempestuous world of waters” (*The Last Man,* 287) attacks the literal and symbolic defences of England as “vast fragments of the near earth fall with crash and roar into the deep” (287-288). The “greater part” deem this a “judgment of God” (288) as conventional plots interprets both unusual and more frequent convulsions in nature. Then, in watching the sunset, where a forecast of the next day’s weather might be elicited in folkloric

sayings (red sky at night, shepherd's delight), an event akin to parhelia (sundogs or mock suns) is observed in wonder by the group:

> When the mighty luminary approached within a few degrees of the tempest-tossed horizon, suddenly, a wonder! three other suns, alike burning and brilliant, rushed from various quarters of the heavens towards the great orb; they whirled round it. (288)

Parhelia, referred to as early as Aristotle and Cicero, were well documented scientific phenomena, appearing in the *Philosophical Transactions of the Royal Society* during the eighteenth century.[83] However, the account in *The Last Man* does not seem like a naturalistic appropriation of sundog stories. The movement and circling—"the sun itself seemed to join in the dance"—and uncertainty as to whether there are three mock suns, or just two as in the scientific phenomenon, is unclear. The text seems to return to standard eye-witness accounts in stating that "suddenly the three mock suns united in one, and plunged into the sea" (288), but then adds "a deafening watery sound [...] from the spot" (289). Afterwards Lionel Verney tells us that "the sun, disencumbered from his strange satellites, paced with its accustomed majesty towards its western home" where "the sea rose to meet it" in a "wall of water" (289). The representation of a sundog phenomenon, the textual "facts," do imply some agency; indeed, the "apparition of these meteors" implies agency, or that which can be attributed to other celestial phenomena. But the unreliability of the witnesses and the reconstructed story refuse to separate fact and fiction: "Scattered and unconnected as they were, I have been obliged to add links, and model the work into a consistent form" (8). The narrator freely admits that "obscure and chaotic as they are, they owe their present form to me, their decipherer" (8). As a result, the process of narrative mediation is constantly transparent in *The Last Man,* and it becomes a book about the process of human narrative and storytelling itself. *The Last Man* interrogates, on the one hand, the reliability of scientific and textual accounts, while, on the other hand, gently mocking the human predisposition to ascribe supernatural causes to natural, and more specifically, celestial phenomena. McKeon (*Theory of the Novel*, 386) argues that: "we owe the very notion of comparative and competing accounts of the same event to […] print". Both print and science encourage a standardisation toward objective and empirical norms, allowing "a test of veracity" through an exact replication of events. The various accounts of scientific phenomena related by various witnesses and reported in an unreliable narration, reconstructed with the aid of human imagination, are the process of *The Last Man.*

The narrator-witness draws in the ideas of Copernicus and Herschel—a sharp redressing of traditional cosmology:

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[83] See Whiston, *an Account of Two Mock-Suns*, for an example linking these occurrences to theories of the earth.

> [...] it appeared as if suddenly the motion of the earth was revealed to us - as if no longer we were ruled by ancient laws, but were turned adrift in an unknown region of space. (289)

The group is given a sudden, "revealed" vision of scientific truth. The "ancient laws" referred to are the legacy from Greek natural philosophy of Ptolemaic cosmology, wherein the world, the heaviest and basest element earth, lies at the centre of the universe. In such a model, all else revolves around, or spirals out from, the earth. Although the spherical nature of the earth was an idea not inimical to Greek natural philosophy, it was Copernicus that is credited with "de-centring" the earth in the universe, and revealing that the earth circled the sun. Herschel, in his paper 'On the Proper Motion of the Solar System', showed not only that the planets of our solar system revolve around the sun, but that the entire system rotates around an unidentified point in the Milky Way, which, in turn, was rotating around other galaxies. This is clearly echoed in Shelley's idea of the earth being "adrift in an unknown region of space" (289). Far from being the centre of a fixed universe, the earth is moving through stellar space. The revelation, then, of this moment, is of earth's lack of specialness. Instead it is one of a plurality of worlds, and rather than being part of a static, permanent and fixed entity, it is "adrift" in space. The tension between supernatural revelation and scientific observation continues in images conjuring up Whiston's *A New Theory of the Earth* (1696):

> Many cried aloud that these were no meteors, but globes of burning matter, which had set fire to the earth, and caused the vast cauldron at our feet to bubble up with its measureless waves; (289)

The image of the destructive power of celestial bodies crashing into the earth (or vice versa) causing global catastrophe evokes Whiston's seventeenth-century work attributing Noah's flood to the earth passing through the tail of a comet. In this case, preparing to be "deluged", the crowd acts out the division of the group into the superstitious—"the day of judgment was come they averred"—and "those less given to visionary terrors" (289). Scientific knowledge and method is pitted against superstition, facts against traditions, and triumphs in this case. However, the pyrrhic victory only left all free of the fear of "immediate catastrophe" (289). *The Last Man* dramatises Cuvierite proofs of deluge engaging the speculative field of theories of the earth. Even the "geology" used to counter such reconciliations of empirical "facts" or "monuments" with scriptural "traditions," becomes comically superstitious; deluge is never delivered.

The flood narrative is revisited after the ramshackle fellowship enters the gates of Dijon, just eighty in number in the last half of Volume III. The "sorrowful procession" is contrasted to humanity becoming *deluge*, which "like a flood, had once spread over and possessed the whole earth", "generation after generation flowing on ceaselessly" (*The Last Man,* 319). But as is said: "He felt that the end of time was come; he knew that one by one we would dwindle into

nothingness" (256). As does the promised apocalypse. The deluge is textually re-incorporated; the human species becomes the flood, now to subside finally into the caverns beneath the earth's crust. The waters of the biblical flood disappeared, a problem engaged by the tradition of theories of the earth.[84] Instead the final shipwreck that casts ashore a Crusoesque survivor on Italian shores is all that awaits. *The Last Man* proffers an expectation-set of apocalypse. A Christian mythical scheme requires *deluge* or conflagration to satisfy a last-man plot. Having established this expectation-set the text resist traditional apocalypse as a factual end of the world. Comets, celestial signs, flood waves, earthquakes, all manner of signs of apocalypse are empirically observed in the story. Yet for our protagonist, Lionel Verney, the last man, the "fall" is a gradual one in what may seem a Huttonian universe. The text interrogates science as the knowledge of nature in 1818. It engages with theories of the earth as the appropriate genre to attempt to reconcile facts, monuments and traditions—or in other words, the present, the past and the human mind, the observer. In 1818 science was a battleground, and *The Last Man* attempts to harness that power of nature as literature. The engagement of eternalist theories of the earth with scripturally aligned counter-theories is a recognisable discourse and conflict inhabiting the novel's space. Moreover, the realignment of *Essay* to progression and transmutation from the 1817 edition produces a new, Jamesonian Cuvier.

Another important cultural strategy disseminated through narrative texts is the struggle to counter and suppress Lamarckian theories and practices representing forces of social upheaval and disruption. *The Last Man's* failure to provide a consistent theory of the earth to suppress eternalism allows temporal space within which Lamarckian transformism may operate. Moreover, as Secord has noted, Jameson had already begun the process of realigning Cuvier's *Essay* to reflect his own probable Lamarckian sympathies. Where Volume I charts England-become-France's history from Republic to the death of a "napoleonic" Empire, Volume II maps out the dissolution of human society struck by the disaster of disease. Society is inverted at the beginning of Volume III, the poor enter the houses of the rich (*The Last Man,* 248), the rich die on the "threshold of poverty" (251). A striking image of a poor woman dead in "garb of splendour" before the mirror and on the toilet in a rich family's house illustrates this (250). Sterrenburg (*Anatomy of Failed Revolutions,* 326) highlights how post French Revolution "visions of utopian social reform […] gave way to premonitions of apocalyptic annihilation". As a result, even Lamarckian transformism offers little more than mutual extinction. "We were all equal now", is repeated like a mantra, "but near at hand was an equality still more levelling [...] a state where beauty and strength, and wisdom, would be as

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[84] See Rudwick, *Bursting the Limits,* 3.1-3.5, for a full account of the varieties of theories of the earth.

vain as riches and birth." (249) Ironically, the utopian emerges from the dystopian in an inverted Malthusian outcome: "the products of human labour [...] were [...] far more, than the thinned generation could possibly consume". Continental political radicalism seeps through: the rich out-consume their needs, but gone, they leave a surplus behind beyond imagination. Geoffroy had taken on Cuvier in 1825 arguing that change, at times radical change in forms, could take place due to external environmental factors. He went as far as to use monstrosities as an example of how fast—in fact in one generation—that transformation could take place. In short, transformism could be brought in line with catastrophic views of change in the natural world. The levelling of human society could be interpreted as such a change in *The Last Man.* But instead it seems to represent degeneration and ultimate extinction; a nature, Sterrenburg points out, no longer hospitable:

> Far from demanding a universal regeneration in the realm of politics, nature now seemed to be con spiring to destroy all of civilization through such catastrophic agencies as fire, storm, flood, earth quake, or epidemic. Nature was no longer a refuge; if she was a bride, she was a destructive one. (*Anatomy of Failed Revolutions,* 326)

Differing structural models are introduced and discarded throughout the book, as scientific method and print records produce "a test of veracity" (McKeon, *Theory of the Novel*, 386). The protagonist-narrator quotes from Burke's *Reflections* "perpetual decay, fall, renovation and progression" and declares, "Strange system! [...] that thus man remains, while we the individuals pass away" (*The Last Man,* 180). This Burkean political organicism—"a permanent body composed of transitory parts"—falls, just as all other models or systems in *The Last Man*. Two points can be raised here. First, that the political organicism echoed in the text can find analogous qualities in Lamarckian transformism. Initially, work was done on change or morphology by degeneration through speciation. In this model complex forms degenerated toward simpler ones, allowing for a very different organic model for nature. Lamarck does not, however, allow for renovation as a secular salvation. Nor does *The Last Man* seem to offer any "renovation and progression" beyond an entirely speculative reading of text. Indeed, if the world is begun again then we are destined only to fail. Second, the body politic finds analogue in species who also remain while individuals pass away. The role of the individual is critical in making change in historical Lamarckism; however, that individual is subordinate to species. This is in sharp distinction to later Darwinian evolution where characteristics could be transferred only at conception. Transformism allows for individuals to change in their lifetime. Lionel Verney concludes apostrophising:

> Lie down, O man, on the flower-strown earth; give up all claim to your inheritance, all you can ever possess of it is the small cell which the dead require. (248)

The shift in nature goes through every level of the universe. On earth—"She could take our globe..." (183)—nature is hostile and mocks human "dominion" at the top of the scale of beings, as any fixity of species is thoroughly subverted. This vast indifference derides fallen and degenerate humankind: "Nature was the same, as when she was the kind mother of the human race; now, childless and forlorn, she was a mockery; her loveliness a mask for deformity" (257). There are many images of society and nature disintegrating: "the corn [...] lay in autumn rotting on the ground" (216); "death fell on man alone" (216). Man seems to be rotting away leaving nature purified: "the ploughman had died beside the plough" (250). The relation between man and nature is inverted; though in sum, man's mooted power over nature seems to have been simply human rhetoric. *The Last Man's* interest lies purely in the human world, the animal kingdom of secondary significance. But even the human world, the human mind that gains knowledge of nature begins to "degenerate", i.e. experience speciation by regressing from complex to simple forms. The synecdochal structure of human society breaks down into a form of animal primitivism, into the "animal machine". This very trope occurs in Cuvier in *Species of Elephants* to describe his initial vision of organised beings circa 1796. Divested of the human world, these humanoid, automaton brutes bear witness to the anatomical functional harmony within. Their *telos* or purpose is internal, not part of society and human history which has collapsed. After tall tales are told as Raymond's soldiers prepare to storm Constantinople, the cohesive, societal force that gels the men together simply falls away and they seem reduced to a more primitive and naturalistic state:

> Each individual, before a part of a great whole moving only in unison with others, now became resolved into the unit nature had made him, and thought of himself only. (155)

Indeed, at the end of Volume II, Lionel entreats them to leave England in search of "some natural Paradise" (243). However, it is only as a response to evident disorder throughout society. Sterrenburg equates this with Romanticism, as "nature replaces politics and offers a haven from the Jacobin Revolution" (*Anatomy of Failed Revolutions,* 325). The retreat to nature is also a move away from the larger collective in a failing society. Man as individual performs "animal functions", but as "lord of created nature [...] existed no longer" (251). Secord (*Edinburgh Lamarckians*) demonstrates how Cuvierite proofs were pulled and pushed wherever expedience needed. This is not to question the heartfelt sincerity of science practitioners, but beliefs like humans are changeable; and as many historians of science have noted, bills must be paid and favours garnered, enemies scuppered, careers furthered. We do know, however, from Cuvier's continued attacks on Lamarck and his heated debates with Geoffroy that their collaboration of the 1790s had evaporated into nothing; friendships had become bitter rivalries. But by 1817 for English readers the Cuvier of

Essay was no longer wholly inimical to Lamarck, but rather in healthy philosophical dialogue with him. Cuvier's teleological comparative anatomy found functional integral purpose in organised beings; every part of a species had a function and a functional relationship to all other parts, as, indeed, to its habits and habitat by inference. This was the law of the correlation of parts promoting a non-directional fixity of species. Previous scales of beings were pyramidal placing complex forms i.e. humans at the top. Hence, the societal inversions in *The Last Man* have little relation to Cuvier's teleology. A chain of being must be established in order for such an inversion to work. Watt (*Rise of the Novel*, 14) writes that before the novel: "since Nature is essentially complete and unchanging, its records, whether scriptural, legendary and historical constitute a definitive repertoire of human experience". Cuvier's law of correlations, at least in part, described an anatomy complete within its conditions of existence or environment. Lamarckian morphology, by contrast, allowed for transmutation between all forms based on a unified principle of life. Lamarckian transformism as fully outlaid in *Zoological Philosophy* (1809) presented irresistible directional progression in life from simple to complex forms. Both saw a nature in harmony; both knew a human world that was, at best, unreliable.

Two contradicting experiences and understandings of time provide plot tension: on the one hand, the foreboding of Cuvierian catastrophe, annihilation, destruction; on the other, the sense of time and space that is infinite—Hutton's "no vestige of a beginning,—no prospect of an end". In Volume II, when Lionel Verney soliloquises regarding the partygoers at Windsor—"Ye are all going to die, I thought; already your tomb is built up around you." (*The Last Man,* 189)—both a Cuvierian catastrophe and Huttonian eternity resonate. The coming Cuvierian extinction, of which both narrator-protagonist and audience know, will destroy the youths; but they will be buried in the earth for an eternity, in a world that, seemingly, has no end. Having approached this from the natural world, and attendant debate over theories of the earth, and then from the human world, and concomitant anatomical debates that affect life sciences, it remains to consider the individual, and here the protagonist-narrator. How do we reconcile this dramatic moment of denouement and survival? As Watt (*Rise of the Novel*, 14) has noted, the romance form predating the novel—as indeed all forms predate the novel—draws stories and characters from traditional, historical and mythological plots. *The Last Man* is, at its centre, a romantic retelling of biblical stories; the individual as hero and anti-hero loom large in its narrative. In its defining moment, at its very death, the protagonist-narrator confronts life and death, not just as an individual, but as representative for an entire species in what Sterrenburg (*Anatomy of Failed Revolutions*) describes as an autobiographical memoir. Buckland and Cuvier used extinction to counter eternalist theories of the

earth and transformist zoology for different reasons. *The Last Man* does not offer biblical reconciliation, but, through its very perpetuation of scriptural stories, it could be read as natural theology. Lionel Verney certainly seems to hold some sort of deist belief in appealing to the "ever-open eye of the Supreme" (365).

At the start of Volume III, as emigration from "dank and cold" (*The Last Man,* 253) England begins, Lionel alludes to *Paradise Lost*, where "Like to our first parents, the whole earth is before him, a wide desart." (252) This allusion to the biblical fall cycles time and places us both in the present and "the beginning of time" (253). The drama of man's fall from grace and expulsion into the wilderness and death is replayed in *The Last Man*. But this time, it is the civilised world of human dominion—outside of the original paradise—that is made the new paradise. Man and his "giant powers" (252) has, seemingly, made a paradise of exile, only to be forcibly exiled once again. Lionel declares: "The south is the native place of the human race;" though, of course, the reader knows that only one of the fellowship will survive. Rather than reprising the religious narrative of the bible, the fundamental human drama implies a recurring, naturalistic scheme. This, of course, is the function of theory of the earth; to reconcile new observable proofs, facts and monuments, with traditions i.e. scripture and their legitimacy. Their conviction that the survivors should leave their homeland and seek out milder climes indicates an Ecclesiastesian worldview of stoical acceptance: "He felt that the end of time was come; he knew that one by one we would dwindle into nothingness." (256) And yet, in this end-time of inevitable annihilation, the strength and courage is found to lead the few out of their now-inhospitable Eden and away toward a new paradise.

> [...] an uninhabited rock in the wide Pacific, which had remained since creation uninhabited, unnamed, unmarked, would be of as much account in the world's future history, as desert England. (295)

This inversion of paradise and exile implies a binary spatial and temporal division of the earth, similar to Deluc's system inherited by Cuvier. Any end-time inevitably collapses any eternalist model. At the same time, "desert England" is equal to any other rock.[85] This implies equality throughout nature's system, in a unity of life that allows movement and morphology between all points and times. When Lionel Verney ventures that "nobles, nature's true nobility, who bear their patent in their mien, who are from their cradle elevated above the rest of their species, because they

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[85] "Each day I repeat with bitterer feelings "Life is the desart and the solitude — how populous the grave." and that region to the dearer and best beloved beings which it has torn from me, now adds that resplendent Spirit, whose departure leaves the dull earth dark as midnight […]" (*Journals*, II, 479)

are better then the rest" (176) then the reversibility[86] of the text reminds us that these nobles will later be dying helpless without their servants. The statement is satirically ludicrous — it is an in-joke, a nod to a savvy audience that shares the layered temporal and spatial perspective of author to frame narrator to protagonist-narrator. The reader knows that, although individuals and individuality are praised, ultimately, all are rendered equal before plague and extinction. This is the realisation of a utopian ideal in dystopia, catastrophe and extinction. However, against this idea "that thus man remains, while we the individuals pass away" (180), linked in the text to Edmund Burke's (1729-1797) organicist vision of "perpetual decay, fall, renovation and progression" (180), there is the survival plot of the individual. It is the individual who survives to renovation and progression. In Cuvier and English catastrophism the individual, hero-like, passes on into eternity either as fossil remain or as species progenitor; though it is pertinent to remember that even Noah made provision for sexual partners. Verney, in contrast, is left to sail the world in search of a potential mate. In Lamarck and transformism, the individual changes through both habit and habitat, potentially in a single lifetime. But the increased eternalist scale of earth makes real progression and change inevitable. These two counter-positioned—and also aligned—theories of the earth or natural philosophical positions thriving in the broader political currents of nineteenth-century Britain create tension against the normative societal myth of origins.

M. H. Abrams argues that the secularisation of "inherited theological ideas and ways of thinking" (*Natural Supernaturalism*, 12) allow biblical structures of innocence, fall and redemption to persist. The organicist universe apparent in Burke (*Reflections on the French Revolution*), and completed in evolutionary biology, offer little for the individual. Cuvier's prehistoric worlds were, by contrast, reconstructed from individuals and survivors. *The Last Man* does not, in the end, deliver on the promise of species extinction. The text survives for a readership, the race survives through the individual. We both witness and do not witness the very last person on earth. At the very end, the reader's perspective zooms up and out from the solitary Verney on his tiny vessel:

> Thus around the shores of deserted earth, while the sun is high, and the moon waxes and wanes, angels, the spirits of the dead, and the ever-open eye of the Supreme, will behold the tiny bark, freighted with Verney—the LAST MAN. (365)

Lionel Verney's narrative ends with a deist rejection of revealed religion, but acceptance of a supreme being configured by reason and the natural world, the God of Natural Theology. Verney intones "I form no expectation of alteration for the better; but the monotonous present is intolerable to me. Neither hope nor joy are my pilots—restless despair and fierce desire of change lead me

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[86] See Allen, *Mary Shelley,* for issues of reversibility in *The Last Man*.

on" (365). The plight of the individual is central to *The Last Man*. The larger scale dramas are all to position the individual in nature, in this the book follows the concerns and formal tendencies of the novel genre. The Lamarckian strains pose questions of change through habit and habitat, and that perhaps is all that is left for Verney in the scene.

Summary

The competing science stories of Hutton, Cuvier and Lamarck combine to produce a new representation of nature in *The Last Man.* The book foregrounds narrative processes in a scientific and textual test of truth claims in order to establish what is fact and what is fiction. Ultimately, the self-conscious sharing of process breaks into parody and skepticism in its empirical approach. The story becomes a story about writing fiction, and about textually reading the past. These two complementary modes make Shelley's novel an exercise in genre and form. The frame narrative incorporates scientific and textual practices into the novel's method. The main narrative then tests not only stories of political change as Sterrenburg points out, but also science stories including various theories of the earth from Hutton, to diluvialism and Deluc, to Cuvier and Lamarckian biology and change. These different stories are never resolved. Indeed, the very nature of the narrative as textual exegesis and empirical scientific method mean that no simple resolution can be afforded. The speculative science of theories of the earth is interrogated and even anatomised, but never resolved into a simple answer. The novel does however preserve the individual experience of critical interrogation through the narrator. It successfully links the individual experience of reader with the individual experience of the narrator-witness before the theories of the earth and Secord's "rhetoric of spectacular display" (*Victorian Sensation*, 439).

7 British Cuviers: Lyell and Lamarck

The late 1820s and 1830s provide us with a new raft of practitioners to cast for the role of British Cuvier. This chapter considers some of the candidates in the principally geological debate. At the same, Cuvier's functional anatomy plays a central role in the formation of British positions in the growing discourse on evolution. In some ways, Cuvier will always be positioned contra Lamarck and Geoffroy, particularly as a result the public debate of the early 1830s regarding directions in anatomy. But Cuvier continued to mean different things to different people, at different times and in different places. The thirties is an interesting point in hand as Cuvier, darling of the conservative forces of Anglican elite England, is central to an internal campaign to rid geological science of unnecessary theology. At the same time, anatomy and biology develop similarly theoretical directions that continue to worry elites in their materialistic and revolutionary nature. Desmond notes "Clearly Lamarckism had some disreputable associations. It was being exploited by extremists promoting the dissolution of Church and aristocracy, and calling for a new economic system" (*The Politics of Evolution*, 4). In response, the Anglican elite represented in the various societies, including the newly inaugurated British Association for the Advancement of Science in 1831, looked to reconcile scriptural authority and geology further. The Bridgewater Treatises were part of the continued campaign to reassert theology in science practice and reception through the volatile 1830s. The eighth Earl of Bridgewater, Francis Egerton (1756-1829), left 8,000 pounds to commission scholarship on natural theology. The result was the Bridgewater Treatises, eight scholarly tracts published between 1833 and 1836; four of the authors were clergymen. It was a case of preaching to the converted, as the first editions were far too expensive to reach any but an elite readership. Regardless of the prohibitive cost, it sold ten thousand copies (Secord, *Sensation,* 56). But the idea was clear: to resist dangerous materialism and atheism through accessible, well written illustrated guides to fields such as geology and anatomy where socially destabilising continental, and primarily French, science was promoting materialism and radicalism in undesirable elements.

The Treatises were written specifically for nonspecialists and constitute rather avuncular boundary work to control and delimit the understanding of proper science. Cambridge don William Whewell (1794-1866), author of the highly influential *History of the Inductive Sciences* (1837), contributed *On Astronomy and General Physics* (1833), coining the term "the nebular hypothesis".

The two treatises of particular note for the current study, however, were those of Charles Bell (1774-1842) and the redoubtable Reverend William Buckland. Bell's *The Hand: its Mechanism and the Vital Endowments as Evincing a Design* (1833) stresses Cuvierite functional anatomy in highlighting the hand of the creator in the natural world, effectively aligning Cuvier with natural theology. Bell's intention is clear: to counter materialism and, in particular, Lamarckian biology and Geoffroyan anatomy. They were "clinging to the greatest absurdities" (*The Hand*, 114); Bell (206) emphasised philosophical enquiry over experiment as a control mechanism to the proper use and understanding of science—clearly anathema to the hardline empiricist Cuvier. Bell's work can be seen as policing of the proper direction of science from the cultural centre of Edinburgh, where anatomists Robert Knox (1791-1862) and Robert Grant (1793-1874) were promoting the new anatomy of Geoffroy and the ideas of Lamarck. The second treatise of particular interest is Buckland's classic two-volume *Geology and Mineralogy Considered with Reference to Natural Theology* (1836). Buckland was the leader of the diluvialist camp that saw Cuvier's proofs of the deluge as definitive in synthesising geology and palaeontology with scriptural authority and thereby upholding the status quo in 1830s Britain. But other gentlemen geologists were looking to release geology and palaeontology from the increasingly old-fashioned and outmodish need to reconcile science with scripture at all. Charles Lyell (1797-1875) was Rev. William Buckland's student as an undergraduate at Oxford, but became the leader of the opposition to Buckland's diluvialists in the lively debates about the Flood at the Geological Society through the 1820s (Secord, *Introduction*, xxv).

Lyell wrote in an article in the *Quarterly Review* in 1827 that students might "confide themselves to his guidance, as Dante in his sublime vision followed the footsteps of his master" to "recal from oblivion the secrets of the past" (*Vol. 36*, 473). This descent into the earth promised magical powers akin to Cuvier's necromancy and ability "to burst the limits of time". Lyell's epic, indeed not unlike Cuvier's, would paint the progress of society from poetry to reason:

> In an early stage of advancement, when a great number of natural appearances are unintelligible, an eclipse, an earthquake, a flood, or the approach of a comet, with many other occurrences afterwards found to belong to the regular course of events, are regarded as prodigies. The same delusion prevails as to moral phenomena, and many of these are ascribed to the intervention of demons, ghosts, witches, and other immaterial and supernatural agents. By degrees, many of the enigmas of the moral and physical world are explained, and, instead of being due to extrinsic and irregular causes, they are found to depend on fixed and invariable laws. The philosopher at last . . . rejects the fabulous tales of former times, on the ground of their being irreconcilable with the experience of more enlightened ages. (Principles, *I,* 86)

This shift to the perspective of actualist science—where the invisible is explained by the visible, and the present is the only set of causes that can be applied—is hardly a move away from the purely empirical methods of enumerative induction of Cuvier. Cuvier had read the past and its record, but had been tied to the evidence and physical observations available to him; in this, Lyell was no different. Traditional accounts have placed Lyell's geology in juxtaposition to Cuvierite catastrophism; the latter being a construct of Whewell's doing. The traditional account argues that Uniformitarianism re-inflates the fossil and geological record with all the minute detail re-injected. Uniformitarianism is a closed steady-state system where minor shifts may effect greater changes, but in a system that eventually balances itself out. In that sense, it recalls Hutton's world machine where time becomes cyclical and anti-historical. It has become accepted as part of a binary division of two diametrically opposed schools, representing forces of progression and reaction respectively. Perhaps the greatest counterfactual evidence in this debate is Lyell's own *Principles of Geology* (1830-33) where Lyell presents a litany of "terrific catastrophes" in Book II that would "out-catastrophise" any supposed catastrophist. Lyell's claim is that "the stability of the earth" is chimerical, rather like believing the earth is flat or that the sun goes round the earth. Secord (*Introduction*, xix) claims that Lyell's *Principles* is not a cycle, or series of cycles, or a plot of incremental change, but that instead geology cannot provide any narrative. There is, was and will be no stability; records are incomplete. In this sense, Lyell's geology is an extension of Cuvier's, and a successor to his strictly empirical approach. However, Lyell did feel a need to combat the philosophical arguments of the science climate of 1830s Britain, unlike Cuvier in his context. Lyell hints that the present is united with the past when he writes of Cuvier that our system of classification is "an acknowledgement […] that part at least of the ancient memorials of nature were written in a living language" (*Principles*, *I*, x-xi). Lyell incorporates and recognises the mechanism of catastrophe and catastrophic change, but it becomes, first, normalised into the present, and, second, not part of a volatile past—instead the past can only be understood through the present. Not time travel, but time speculation; the two periods are unified in a conscious act of imagining. In this imagining there are variables that may produce skewed results. The fossil record may be fragmentary, the evidence misleading; change may seem catastrophic (even though he argues it often will be).

Lyell's incorporation of Cuvier, not as a "former world" but as a theoretical past, present or future, brings catastrophe back from the safe distance of spectacle and into the humdrum of everyday existence. He appropriates Cuvier's catastrophes (or Whewell's "catastrophism") into a sophisticated theoretical argument that can allow speculative travel beyond the bursting-points of

time and space. Lyell places the human world separate to the narrativeless one of nature. In this sense, there is no substantive break from Cuvier in ultimate resistance to overarching plot. Strangely, if anything, Lyell's vision, at times seemingly of "another earth", was more catastrophic than Cuvier's. Cuvier's vision was of a reconstructed past, of beginnings, Lyell's always of "another earth" beyond the geological record and separate to human history. Secord (*Introduction*, xix) points out that recent historians have perpetuated simple dichotomies, such as Whewell's uniformitarian contra catastrophism in the 1830s. More recently directionalism contra steady-state has been prevalent. But Secord underlines, "*Principles* claimed that *any* kind of global narrative would prove impossible to reconstruct, as too much of the record has been lost." In this sense Lyell dons the mantle of his hero Cuvier with ease, and without any contradiction, their position being one and the same. The major difference was Cuvier's inherited sense of a binary division of present causes somehow not being the same as in the ancient world. A common belief widely held and not specific to Cuvier. *Principles* seeks not only to divorce geology from theology—if not from natural theology in that the world was indeed proof of the hand of a benevolent God—but also to continue the empirical and inductive methodology of Cuvier as applied to geology. Sadly, of course, Cuvier was dead before it was complete. But a third, and perhaps critical element to Lyell's position was in countering any claims of Lamarckian materialism that may arise. His geological world had clear affinities to Hutton's and hence classic Enlightenment eternalism. But Lyell himself was appalled at the possibilities of Lamarckian transformism; as professor of geology at King's College London in the 1830s he was only too well acquainted with fellow Scot and member of the Geological Society, Robert Edmond Grant's Lamarckian and Geoffroyan tendencies at the University of London. Desmond describes Grant's lectures as "a clearinghouse for Geoffroyan ideas in Britain", and a probable cause in the decline of "Cuvierian teleology". (*Grant: A Pre-Darwin Transmutationist*, 214) The first editions of *Principles* were far too expensive to reach beyond a genteel elite. But Lyell understood the threat of the Anglican clerical orthodoxy. His last-minute additions to the first volume (Secord, *Introduction*, xxxi) denied any progressive history of life, meaning his principle of uniformity countered any of transformism. The second volume included greatly expanded chapters on changes in the organic world and a substantial refutal of any progressive view of life. Cuvier's mummified animals from his original refutations of Lamarck were again recalled (*Grant: A Pre-Darwin Transmutationist*, 205). Human specialness was preserved by the separation from the natural world and Lyell's geological chair at King's College secured. Secord notes (xxxiv) that refuting Lamarck led Lyell to deny a progressive narrative in the fossil record and return to climate change and the fragmentary nature of the geological record. In some ways this aligned Lyell even

more significantly with Cuvier. By rebutting Lamarck, Geoffroy and transformist practices, Lyell allied himself with Cuvier's functional comparative anatomy where transitional forms were unacceptable as possible evidence of progression in a proto-evolutionary scheme. Like Cuvier, his actualist method of visible, empirical causes would promote "the progressive character not of nature, but of human reason" (Secord, *Sensation,* 61).

The three spaces of debate in 1830s Britain this chapter points up are all cultural positioning for the contest to speak on behalf of nature; a contest that can be placed within a broader political and ideological narrative. First, Buckland's success in synthesising geology and natural theology in the 1810s and 1820s is challenged. The Bridgewater Treatises work to safeguard diluvialism and Cuvierite anatomy yoked to natural theology by continuing to combat destabilising ideological and political undercurrents in society based on continental science and revolutionary thought. The July Revolution of 1830 in France and the 1832 Reform Act in Britain emphasised the need for societal cohesion while Lamarckian ideas and their practices were a tangible presence and threat. Cuvierite geology and anatomy were central to conservative elements such as the diluvialists and featured heavily in the whole Bridgewater Treatise project. At the same time, Cuvier's anatomy, palaeontology and geology were subsumed into Lyell's uniformitarian geology that sought at once to both resist the reactionary religious attitudes and practices of the diluvialists and to combat materialist forces in the form of Lamarckism. Desmond clarifies: "Lamarckism was never a neutral or dispassionate issue: to many it heralded radical extremism, if not revolution". (*Grant: A Pre-Darwin Transmutationist*, 214) Cuvier was appropriated in the continued battle for political stability in Britain, and aligned with the progressive nature of human reason—the narrative that could police that struggle. His position continued to be central to the political and ideological debates in British science.

Bucking the trend: Eliot's *Mill* in the 1820s and 1830s

Having established scientific context in Britain in the 1820s and into the 1830s, I return to the criticism that represents differing approaches to Eliot. My division of *Mill* draws focus to the 1830s setting of the story, not the 1860s site of authorial intention or reader reception. The former is the natural alignment of formal criticism and biographical approaches, whereas reader reception situates meaning in the practice of reading and textual artefacts. These all constitute legitimate approaches and reading strategies. However, in the case of *Mill* I contend that the science of the story, as opposed to the fabula and text, or the context of the setting, produces a coherent and useful

reading. In *Mill's* case this means a focus on the diluvialist camp of the 1820s and 1830s and the Bridgewater Treatises on the one hand. On the other, we focus on the positions of Lyell and actualist science in producing a geology and palaeontology discrete from theology. All the while, the constant threat of and struggle against Lamarckian radical science provides a useful context for the original setting of *Mill* through 1830s Reform Britain.

Shuttleworth (*George Eliot and Nineteenth-Century Science*, 55) argues that the story embraces "conflict and contradiction" over progression and development. Insofar as it tells the story of the main characters' catastrophically truncated lives, it plays out a narrative of loss. At the same time, Eliot's historical vision that reaches up and out beyond "the level plain" places the story of two individuals within a broader context of the strata of society and the natural world. The metaphor of the river, a civilising force echoing out from Cuvier in his *Preliminary Discourse*, emphasises both broader historical contexts contra poetical and romantic treatments of individual lives. Shuttleworth reads *The Mill on the Floss* as providing two distinct beginnings and endings, and hence two models of time. The two endings provide, according to Shuttleworth, two competing models of nature: "The concluding flood does not conform to theories of organic evolution but rather to the historical schema of catastrophism" (53). Shuttleworth identifies the two endings representing competing catastrophist and uniformitarian models of science. The second ending is neatly summarised by the narrator's comment "Nature repairs her ravages — but not all" (*Mill*, 422). George Eliot's divided narrative structure becomes an attempt to "resolve the contradictions of organicism" (*George Eliot and Nineteenth-Century Science*, 53). The binary opposition of catastrophism and uniformitarianism used by Shuttleworth does not agree with the reading earlier in the chapter. Lyell and Cuvier are aligned in empirical approaches and the labels of catastrophist and uniformitarian are treated with caution as rhetorical epithets often externally imposed. Moreover, Shuttleworth finds "Darwinian echoes" (53) which situate both meaning and critical focus in the late 1850s and 1860s, when the catastrophist use of Cuvierian science has been "discredited" (53). A narrative based focus on story separates a site of meaning in the 1830s context of *Mill*. In this particular setting, Buckland's perceived divide and rhetorical labelling of the debate becomes an anachronism.

Adelene Buckland's *Novel Science: Fiction and the Invention of Nineteenth-Century Geology* (2013) is a watershed work in many respects, in combining a thorough approach to both the fictions of science and conversely the science of fictions. Buckland's point of departure in specialising in just geology means her grasp of the nature of geological issues and debate are historically detailed. As a result, she questions many of the assumptions of previous work in the

area of literature and science. First, she discusses the use of catastrophism and uniformitarianism in reading Eliot:

> Criticism of George Eliot's novels has often centered on a purported opposition between "uniformitarian" and "catastrophic" models of geological change. Eliot's "realism," most critics contend, is partly derived from her absorption of "uniformitarian" theory. (*Novel Science*, 221)

Realism, like the formal realism of the novel expounded by Watt (*Rise of the Novel*), is equated to Lyell's uniformitarianism, and therefore opposed to "romance". These two supposedly opposed schools of geological thought — the catastrophists and the uniformitarians — were selling "wholesale plots of earth history" (*Novel Science*, 221). Buckland, quite rightly, points out that no two such "schools" ever existed, and in fact, they are rhetorically used in polemical debates to provide distance from previous theories or make space for new ones. Dawson and Lightman point out that "a single individual could, simultaneously, hold entirely different attitudes […] sometimes altering their views merely on the nature of the periodical they were currently contributing to" (*General Introduction*, x). The label catastrophist is then variously applied to Werner, Hutton, Cuvier, Buckland, Sedgwick, Whewell and Murchison and so on. This may not reflect consistent views or perspectives. However, that does not preclude the necessity for " an umbrella-category" (xi). In sum, we cannot deny the usefulness of differing models of geological change. However, debate points up the need to proceed with caution in, first, accepting the rhetoric of the time (which may well be aimed at whipping up interest or dissociating views from others), and, second, accepting the broad definitions of models in these polemics.

Buckland proceeds to present a narrow, exclusive definition of catastrophism and uniformitarianism, one based on the debate as exemplified by two articles in the *Westminster Review*;[87] they constitute "a narrowly scientific argument about the possible causes of the great breaks in the geological record and about the limits of human observation and understanding of the past." (*Novel Science*, 224) By limiting the definition to this methodological debate in particular circumstances, Buckland moves textual meaning to authorial intention at the time of writing and to the narrow, scientific debate of the 1860s. The debate proposed two positions: first, that there was no empirical basis for extrapolating processes observed during the minuscule period of human history over the millions of years of estimated earth history. Second, that this was anthropocentric, in claiming the human mind has the ability to understand things way beyond its ken and natural life. Eliot writes in a notebook from the 1870s:

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[87] Forbes & Spencer's articles. See Buckland, *Novel Science*. Eliot was editor of the Westminster Review at this time.

> Is the interpretation of man's past life on earth according to the methods of Sir Charles Lyell in geology, namely, on the principle that all changes were produced by agencies still at work, thoroughly adequate and scientific? Or must we allow especially in the earlier periods, for something incalculable by us from the data of our present experience? Even within comparatively near times and in kindred communities how many conceptions and fashions of life have existed to which our understanding and sympathy has no clue![88]

These authorial meditations take us through to the 1870s, indeed, these admirable relativist arguments are still valid today. But is this the science of the 1830s' setting? This issue of reading the past and the anthropocentric claim of humans to "burst the limits of time" was one Cuvier questioned. Cuvier did not accept that empirical evidence would likely ever exist to prove an overarching system of earth theory. In the first article from the *Westminster Review*, 'The Future of Geology', Forbes states that there were gaps in the geological record and that the narrative (or sequencing) of geological history was, at best, episodic. In other words, the movement in time and space in charting earth history was quite erratic. Forbes describes pages having been ripped out of the "Book of Nature". This idea of a compressed or incomplete record resonates with Cuvier's "vague, incoherent, and even inconsistent" (Rudwick, *Georges Cuvier*, 182) doctrine. In the second of the two articles in the *Westminster Review,* 'Illogical Geology', Spencer flags the use of inherited terms, claiming so-called "catastrophists" such as Murchison were "caught up in the language of the cosmogonies they had discarded, trapped in a language that contradicted their research"[89] Moreover, Spencer asks whether their outmoded categories and implicit search for beginnings of life were strictly relevant.

Buckland identifies and locates the uniformitarian-catastrophist debate in these methodological issues, represented in texts appearing in the *Westminster Review*. However, all this does not provide much more than discursive evidence for Eliot's position. Rather than dispel this phantom divide appropriated by critics of literature and science, it fuels further debate. There are various issues that must be raised in considering Buckland's position. Writers rarely have clear and testable theories of anything. They are not, in the parlance of our times, "doing science". Moreover, just as Buckland rightly questions the rhetoric of the age, we must also question neat evidential reasoning when applied to the process of academic writing and literary production. Buckland summarises her position:

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[88] In Buckland, *Novel Science*, note 11.

[89] Quote from Spencer. Quote in Buckland, *Novel Science.*.

> This, I am arguing, was the geology Eliot knew—a geology whose primary interest lay in a methodological dispute about the nature of scientific evidence, rather than a geology that offered two "plots" of earth history in rivalry. (*Novel Science*, 383)

This, perhaps, sits comfortably with Watt's description of the formal realism of the novel. Watt argues: "the novel's realism does not reside in the kind of life that it presents, but in the way it presents it" (*Rise of the Novel*, 11). Perhaps then Eliot's method and not the 1830s setting is more useful in reading *Mill*. If so, then the methodological debates of the 1860s could indeed be embedded in the narrative technique representing Eliot's "little Britain" of the 1830s. One way to test this is to apply the model of 1830s context and see how effective it is in reading the novel. However, one major difference must persist. This study encompasses more than just geology, as, I argue, any study of Cuvier must.

Buckland implies that Eliot would therefore have written (or not) the "methodological dispute" of the 1860s into her novel. Buckland's exhaustive research and much-needed historical approach emphasising the need to understand the actual "science" and not just the history of it is both legitimate and of the highest quality. However, we must question whether first Eliot would reproduce these methodological issues above the speculative and more general rhetorical debate, and, second, if so, whether she would then call upon these particular of sources. Indeed, in the above note from her journal in the 1870s she is still wrestling with questions of anthropocentrism, human arrogance and Lyell's theoretical approach which originate in the 1830s. Just, perhaps, as Stephen Guest charmed Maggie with "his wonderful geological story" (*Mill*, 309) of William Buckland's Bridgewater Treatise from 1837. Shuttleworth (*George Eliot and Nineteenth-Century Science*, 28) links *Adam Bede* (1859) with an un-problematised acceptance of Enlightenment science akin to McKeon's "naive empiricism" (*Theory of the Novel*, 384): "George Eliot […] wishes to minimise her authorial role, to insist that she is only recording a given external order". *The Mill on the Floss*, in contrast, reintroduces romantic plot lines and a more nuanced working of nature where the catastrophic and the supernatural are potentially reinstated. The fact that Buckland's Bridgewater Treatise is the only geological text mentioned does not confine interpretation to the bounds of that text and its sphere of influence. However, as a text of natural theology, "On the Power, Wisdom and Goodness of God, as manifested in the Creation", Buckland's Bridgewater Treatise expounds several theories designed to reconcile Cuvier, geology in

the 1830s and scripture.[90] The age of the earth and Cuvier's fossil evidence produce a series of creations over an immense period of time. There is a "succession of natures", just as Cuvier implied, but reconciled to the biblical account. In short, Reverend William Buckland produces a representation of nature that incorporates both biblical account and Cuvier. I argue that this particular geological debate, even if "the kind of life that it presents" (Watt, *Rise of the Novel*, 11), can be useful in reading *Mill.*

It must be asked whether then the methodological disputes of the late 1850s and early 1860s can narrowly determine Eliot's expansive scope in *The Mill on the Floss*. Buckland plays down the importance of religion in the geological debates of the time. Eliot, in contrast, explores the connection (and disconnection) of the two. Buckland discusses the importance of plot — or Secord's "anti-narrative" as equated with "uniformitarianism" contra "catastrophism" as "romance" — and its presence or absence in Eliot. Geology becomes a chance to explore "breakdown, fragmentation, and disconnection" (*Novel Science*, 245) in conventional plots. In this sense, it represents a mode of modernity that interrogates traditional plots and genres. Watt (*Rise of the Novel*, 15) describes this as "what was to become the novel's usual practice". Is "anti-narrative" an unsettled new form of narrative? Does it reflect the formal instability of the novel as a system of narrative? Buckland argues that Eliot uses geological spaces and perspectives to explore both integration and disconnection; meaning then is continually relocated in time and space.

The question of relating Eliot to Cuvier is how well this then resonates with a broad and inclusive definition of Cuvier's work. Catastrophism is an "umbrella-category" (Dawson & Lightman, *General Introduction,* xi) that should be treated carefully. Moreover, Cuvier's work encompasses palaeontology and comparative anatomy, and these biological components are equally important in the work of novelists and Eliot's *Mill.* It is, therefore, inaccurate to oppose Eliot's authorial intention, readership and clear engagement in methodological scientific debate in the 1860s with a strategic reading of *Mill* focused on specific science in specific circumstances in 1830s Britain. However, Buckland's readings based on methodological focus on lack of empirical evidence and anthropocentrism are still relevant in this reading.

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[90] In a letter of 1841, for example, she writes "Dr. P Smith's work on the connexion between Scripture and Geology […] the interpretation of the Mosaic records, is fully satisfactory to me" Smith was among the the foremost exponents of reconciling geology and biblical account.

8 The Mill on the Floss

The paleontological and geological debates of the 1830s onwards form a significant part of the rich context for *The Mill on the Floss.* Serialised in 1861, it has traditionally been heavily associated with and methodologically and formalistically linked to Darwin.[91] The development versus accommodation debate informs *Mill.* Accommodation*,* the practice of reconciling development and design as the Reverend William Buckland does in his Bridgewater Treatise, features in the book. But further to this, the uniformitarian-catastrophist debate placing Lyell's gradualism as expounded in *Principles of Geology* against English catastrophists and Cuvier is a geological debate that has received much critical attention.[92] In conjunction with Lyell, Darwin has been used as a model to engage *Mill*. But more pertinent to Eliot may be the paleontological debate of the late 1820s and into the 1830s, the book's setting. Geoffroy's philosophical contra Cuvier's functional anatomies met head on in their debate of 1830-1832. In Britain, their respective positions were then a fundamental part of paleontological and anatomical debates featuring Lyell in respect of geology, but more importantly Robert Grant and Richard Owen. Lyell's separation of human and natural world allowed his uniform vision of causes to function as an actualist science. At the same time, his method was fully aligned with Cuvier, insisting on visible, empirical proofs in an inductive approach. Lyell is therefore not approached in diametric opposition to Cuvier. It is boundary work in countering and opposing the diluvialists that characterise Lyell's 1830s. Moreover, Lyell aligned himself with Cuvierite anatomy and proofs of extinction in *Principles* in his polemic against Lamarck. The threat of Lamarckian and transformist ideas is acute in Reform Britain and the setting of *Mill*. By refocusing our critical gaze to the late 1820s and 1830s of the setting, I argue that the context shift makes greater sense of the diluvial themes of *Mill.* Moreover, it places the Bridgewater Treatises and diluvialists in sharp relief. Whether Whiggish reform or Tory reaction, these are the political and ideological forces that, in the end, and in their conservatism, drive the tragic central narrative lines.

It is true that *Mill* may have just as much to say about the early 1860s, and, insofar as it was released after *Origin,* it may be critically correct to approach the book from contemporaneous theory and deploy Darwin and mid-nineteenth-century evolutionary models to it. But by reading

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[91] Beer *Darwin's Plots;* Shuttleworth, *George Eliot.*

[92] Beer *Darwin's Plots;* Shuttleworth, *George Eliot.* 13-14, for an alignment of Eliot with uniformitarianism contra catastrophism. Levine, *Darwin and the Novelists.*

the novel and its science in its time-setting of circa 1829-1839 we re-inject all the rich context of the novel's political and ideological milieu. Why would nineteenth-century novelists publishing serialised fiction over a period of months use a period setting unless the material were sensitive? Would *Mill* use a setting some thirty years earlier to voice conflicts over science and nature from the 1850s and 1860s? What would be the potential benefits? The 1830s offer a background of unrest and social reform, of deep political change. There was lively scientific debate between British naturalists: over reactionary diluvialism, proofs of natural theology as popularised through the Bridgewater Treatises,[93] and Lyell's new British geology.[94] In anatomy and zoology, there were the unmitigated advance Lamarckian models of transmutation in both the animal kingdom and extrapolated to the human, accompanied by the spread of continental philosophical anatomy. Current scientific debate is just one of many different spaces and contexts that may be engaged in reading the novel. I hope to demonstrate the opportunities at hand by refocusing on the 1830s, without seeking to exorcise Darwin from the novel's narration and its language. But, I argue, the geological, palaeontological and anatomical contextualisations of the novel incorporate the original setting.

Mill starts in the late 1820s following protagonist Maggie Tulliver and her brother Tom from their home at Dorlcote Mill near St. Ogg's to their tragic demise in a flood on the river Floss in the late 1830s. Mrs Tulliver is one of the Dodson sisters, whose various extended family provides us with "the history of unfashionable families" (*Mill*, 238) in 1830s Reform Britain. The aim of this reading is to engage the science or knowledge of nature in the context of 1830. The frame of the novel and the use of the river and flood as device to do just that will be considered first. This interacts with scientific debate about diluvialism in 1820s and 1830s Britain. However, not only does it engage the forces of theological conservatism that intersect with Cuvier's *Essay* and Buckland's geological treatises, but also the vanguard of a new actualist geology and earth history stripped of biblical structures and traditions. Suitor Stephen Guest charms Maggie with "his wonderful geological story" (309) of William Buckland's Bridgewater Treatise from 1836. The stiff boundary work of the 1830s from the Anglican camp funded by the Earl of Bridgewater's bequeathment looked to answer threats of new uniformitarian geology and its reconfiguration of nature, in addition to the volatile tendencies in Lamarckian zoology and philosophical anatomy that

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[93] Eliot's position was aligned with natural theology in the 1840s: "Each little plant, the very lichens that clothe the dead boughs, are lovely and useful, and a link to what would be missed in the chain of being." See Haight, *The George Eliot Letter*s, I, 123, GE to Martha Jackson, Foleshill, 16 December 1841.

[94] See England & Nixon, *Victorian Science and Literature Vol. 3*, ix-xx, for a brief overview of natural theology and its intersections with geology.

promoted a view of life compatible to reform and even revolution. *Mill's* setting and its overarching structure both reflect and reconfigure biblical provenance.[95] In its interrogation of nature, and at a broader level, the politics of nature, it engages with scientific debate in 1830s Britain, and an 1830s Britain that certainly interrogates Cuvier. Again, we can discern a natural history and philosophy at work, both actively and passively in *Mill.* What is its theory of the earth? The diluvialist faction represented across the various scientific societies aimed to reconcile scriptural theology and new geology in order to promote both their local and wider agenda. Cuvier is used as "English catastrophism" in this policing of the proper use of science. At the same time, however, Jameson's fifth edition of *Essay* had already aligned itself with Lamarckian transmutation and radical historical progressionism.[96] Lyell's *Principles* effortlessly and elegantly subsumed Cuvier's Doctrine of Revolutions into a new uniformitarian geology that separated the progression of human reason and the uniform causes of nature. Lyell's actualist methodology demonstrated the same rigid empiricism Cuvier had, only applied to a different set of proofs and evidences in the 1830s, and a different intellectual and scientific context in which to carve out practitional space.

Both diluvialists and Lyell were fiercely opposed to ideas of development as represented by Lamarckian biology and Geoffroyan anatomy in the 1830s. *Mill's* own thick context of parochial English life has been read as exploring Darwinian themes.[97] By rebooting to the 1830s the context refocuses the historical and critical eye on transmutation. *Mill* pays attention to zoological trends and the animal kingdom is consistently overlaid on the human. There is distinct slippage between taxonomies as the human and animal merge. Cuvier's *The Animal Kingdom* (1817) is credited with effectually replacing the traditional 'scale of beings', transforming the fixity of species from the inherited pyramidal model to an ahistorical and spatial division between four *embranchements*. This constitutes a very different interpretation to an arboreal model, or tree of life. Cuvier's divisions were fixed and impenetrable, safeguarded by invariable functional teleology. However, the fifth

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[95] In Eliot's review of James Heywood's abridged translation *Introduction to the Book of Genesis,* 2 vols. (1855) in the *Leader* of 12 January 1856 (VII, 41-4) Eliot writes: "he must adapt the form of His revelations to the degree of culture, which belongs to men at the period in which His revelations are made" (*Essays*, 256). This idea of cultural adaption and contingency of revelation according to time and place is Eliot's own reconfiguration. She describes Genesis as "a mythical cosmogony, an impossible chronology […] but it finds in them a character which it would be monstrous to attribute to any other than a human origin." (*Essays,* 258) The source of myth and of religious orthodoxy is attributed to "human origin". Eliot explores the tension between *accommodation*, the incorporation of biblical accounts and reconciliation to scientific observations of the present natural world, and *development*, this admission of historical contingency where revelation is adapted to time and place. We are left with "a mitigated orthodoxy or a mild heterodoxy, which allows the presence of mythical and legendary elements in the Hebrew records, and renounces the idea that they are from beginning to end infallible, but still regards them as a medium of special revelation" (*Essays,* 256-7)

[96] Secord, "Edinburgh Lamarckians: Robert Jameson and Robert E. Grant".

[97] See note 1.

edition of his *Essay,* a bestseller in Britain, had aligned his text with Lamarckian transformism.[98] Lamarck and Geoffroy's philosophical zoology and anatomy provide context for *Mill* in 1830s Britain. At the same time, it is clear that Eliot writes from a later time and her narratorial voice engages a different historical time and place. The science of her narratorial voice is necessarily informed with the knowledge of her context. This perspective is not ignored, nor do I posit a structuralist text that exists without author. But the 1830s context of the novel lifts up the pre-evolutionary debates in *Mill.* Moreover, it incorporates a different Cuvier claimed by historical actors new and old.

Bridgewater and Diluvialist Dreams

At an overarching level the seven books of *Mill* draw to mind the account of creation in Genesis, the six days of creation and the seventh day of rest. Creationist tendencies recur, for example, in the singing of Haydn's work of the same name, and in the wooing of Maggie through "wondrous" theories of the earth based on Buckland's Bridgewater Treatise. Book First, 'Boy and Girl', presents Tom and Maggie Tulliver as an alternative Adam and Eve, a brother and sister pairing. They grow up at Dorlcote Mill on the river Floss. Mrs Tulliver is one of four Dodson sisters, giving us four families: the Tullivers, the Gleggs, the Pullets and the Deanes. In Book Second, 'School-Time', Tom is sent to school at clergyman Mr Stelling's and protagonist, and natural scholar, Maggie visits him. While Tom is at school Maggie meets "hump-back" Philip Wakem, son of her father's arch-enemy, Lawyer Wakem. When her brother Tom is finally called home from school, signalling an end to his wasted education, and to Maggie's vicarious one, the age of innocence is over and they exit Eden in 'The Golden Gates are Passed' at the end of Book Second: "They had entered the thorny wilderness, and the golden gates of their childhood had forever closed behind them. (*Mill*, 159) Books Third, 'The Downfall' and Fourth, 'The Valley of Humiliation', taken from John Bunyan's *The Pilgrim's Progress* (1678), document a fall from grace. Tulliver is ruined and ill, the family are humiliated and impoverished. Book Fifth, 'Wheat and Tares', from the Book of Matthew in the New Testament, is a parable used by Jesus to tell of the final judgement and the separation of the "the sons of the evil ones" from "the sons of the kingdom". In the Red Deeps Maggie and Philip Wakem court, only to be caught and separated by Tom. Further ill besets Maggie in Book Sixth, 'The Great Temptation', where love is offered her in the shape of Stephen Guest, but at the expense of honour. Then finally, after the six-day creation story of the book, Book Seventh, 'The Final Rescue' offers a day of rest and redemption. But not before the flood comes and takes brother and

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[98] Secord, "Edinburgh Lamarckians: Robert Jameson and Robert E. Grant".

sister, Tom and Maggie. At surface value, *Mill* presents a creationist structure framed by rivers and floods. *Mill's* biblical superstructure provides a rich intertextual fabula or base for the novel. Watt (*Rise of the Novel*, 13) describes how "literary traditionalism was first and most fully challenged by the novel" and that its originality stems from its rejection of traditional plots. *Mill* provides a clear example of how that rejection of traditional plots incorporates them in order to subvert and create original stories with an air of "complete authenticity" (27). The biblical form is pre-meditatively used, but destabilises both itself and the characters in *Mill*. McKeon (*Theory of the* Novel, 385), although discussing seventeenth and eighteenth century novels, identifies the issues of truth and the instability of the system of narrative genres. This is characterised by what he terms a "basic discrimination" between fact and fiction (385). Eliot's narrative expresses this instability by superimposing traditional bible stories on the "true history" (385) of the individual experience of the novel in its "particularising approach to character" (Watt, *Rise of the Novel*, 18).

Rivers and floods frame *Mill.* Buckland reminds us: "While the flood that ends the novel is often vaunted as a geological flood of either "uniformitarian" or "catastrophic" proportions, for instance, Eliot is in fact careful to leave its causes obscure. Geology is only one of a range of explanatory frameworks suggested for the flood" (*Novel Science*, 232). Shuttleworth (*George Eliot and Nineteenth-Century Science*) reads *Mill* as providing two distinct beginnings and endings, and hence two models of time. The dual narratives flow from single beginnings and ends, converging in the flood that has little effect in the natural world, but great effect in the human. From the beginning, *Mill* is framed by diluvialist concerns, setting up rivers, real and figurative, that drive the narrative to end. The twin rivers of Rhine and Rhone recall that all is "part of the gross sum of obscure vitality, that will be swept into the same oblivion with the generations of ants and beavers" (*Mill*, 248). Vitality may point up a deist belief in a life force, shepherding humans and animals into the same ontological pen, all to be swept away into an ahistorical abyss. *Mill's* darkest vision here is one of human insignificance in nature's scheme. The materialist Rhone—the bleaker strand of the Floss—encapsulates a meaningless life leaving nothing but "ruins". The Rhine and the Rhone trace two possible histories located within one current of the Floss. The duality of rivers and their temporalities seem to imply a fact-fiction divide (McKeon, *Theory of the Novel*, 385). One might be factual, the other fictional, but the confusion lies in which is which. Ants and beavers are washed away into oblivion on the shoreline of ruins symbolising a dark view of history caught between Cuvier's successions of natures and materialist progression. In Book Fourth, *Mill* spells out its vision of parochial life immediately after introducing the twin historical ebbs of the Rhine and the Rhone. The metaphor of two great rivers of existence like the Tigris and the Euphrates is

extended to the Tullivers and Dodsons. *Mill* posits the Tullivers and Dodsons as pagan contra Christian, robbed of "an outlet toward something beautiful, great or noble". They are "a population out of keeping with the earth on which they live" (222). What does *Mill* mean by this? Does it mean that the earth has a different scheme to their "childlike spelling-out of what nature has written"? They are also out of keeping "with this rich plain where the great river flows forever onward, and links the the small pulse of the old English town with the beatings of the world's mighty heart" (222). This image and scheme of the "great river", presumably of life, extends and spirals out to an image of "the world's beating heart"; a fully organic system where the planet is an organism, where all life is connected. *Mill* seeks to extirpate its ant-like Tullivers and Dodsons and advocates a "vigorous superstition, that lashes its gods or lashes its own back" (222). Superstition destroys the romance and poetry of the Rhine and, at the same time, collapses itself. Shuttleworth contends that *Mill* admits no "progress or a discernible plan in nature" (*George Eliot and Nineteenth-Century Science*, 60). The text's narrative instability is unresolvable, just as its science story and representation of nature remains in "conflict and contradiction" (55).

Mill's rhetorical narrative device is to express what the reader is thinking then to share in it with them, in their experience of this parochial "oppressive narrowness" (222). *Mill's* stream of the "onward tendency of human things" (222) is matched by a similar progression in nature through the generations so that "suffering, whether of martyr or victim, which belongs to every historical advance of mankind" (222) is rooted firmly in the family and "hundreds of obscure hearths" (222). As science strives after a "unity which shall bind the smallest things with the greatest" (222) i.e. a natural law based in empirical observation and then reflective science's theoretical sense of overarching plot where "there is nothing petty in the mind that has a large vision of relations" and "to which every single object suggests a vast sum of conditions" (222). Human life is analogous with this understanding of the synecdochal interrelation of great and small in nature. *Mill* echoes Cuvier and transformist debates as constant subtext in 1830s Britain. The law of the correlation of parts, underlying Geoffroy's concepts of unity of type, informed tensions and debate between proponents of functional and philosophical anatomy. In 1844 *Vestiges* traced life in a novelistic narrative as deriving through organic stages in a battle against Cuvierite extinction and for survival. *Mill* leaves the arguments open to the superimposition of a more suitable sort of Christianity—perhaps one that would make sense of what "nature has written" without casting "dark shadows" (222)

> Their theory of life had its core of soundness, as all theories must have on which decent and prosperous families have been reared and have flourished; but it had the very slightest tincture of theology. (223)

In the rhetoric of the narratorial voice their lack of theology points them up as "semi-pagan" (223). Yes, we must remember that these "chapel-goers" were dissenters, and *Mill's* gentle barracking of the simple and primitive Tullivers and Dodsons may also belie a socio-religious agenda where their heresy played on simplistic and parochial peasant hearts: "The Dodsons were a very proud race" (223). *Mill* sets up racial separateness and characteristics in the Tullivers and Dodsons. These typologies appear throughout the book, often simple dichotomies of Roach and Pike, Rhine and Rhone: "The same sort of traditional belief ran in the Tulliver veins, but it was carried in richer blood, having elements of generous imprudence, warm affection, and hot-tempered rashness." (224) *Mill* tells us that tradition is a key element in an organic worldview where generational inheritance plays such an important role. However, it also leads to typologies and classification e.g. phrenology where physical characteristics determine moral ones. Here, the Tullivers and Dodsons are types and races, boundaries that are reinforced and yet ultimately destroyed. Ultimately, genealogy seems a more potent force than any theological disposition. The Tullivers are presented as a type, fixity in Tulliverness. Both Maggie and Tom change their lot, they effect change, though often through external factors. *Mill* never resolves itself to a Lamarckian drive for progression from simple to complex. It both resolves its human plot, but not its nonhuman plot of the natural world in Cuvierian *deluge,* a diluvial denouement. But it is not the deluge of a binary division of ancient and modern world. It reflects a Lyellian ability to separate the natural and human worlds through the specialness of reason. The one river floods to a human end; the other to a natural eternity.

Lyellian Actualism

The scope of *Mill* is constantly enlarged to encompass earth history. St. Ogg's is described as "a continuation and outgrowth of nature" (*Mill*, 98); this may imply some form of progressionism, the human world extending out from nature and the natural world. Indeed, they are never coextensive. Natural and earth history march on regardless in *Mill*. Indeed, the human narratives of legend and myth are unreliable, the narrator choosing that which is "likely to contain least falsehood" (98). Eliot's narrator presents a form of McKeon's "naive empiricism" contra "romantic idealism" (*Theory of the Novel*, 384). However, Eliot's narrator shares this textual complexity and unreliability with the reader. *Mill* becomes an empirical examination of the romantic, and, moreover, a study of texts as an exercise in how to tell truth in narrative. Eliot constantly subverts any simple and artless attempt to present her various accounts as unmediated truth. Instead, textual complexity resists simple plot denouement, just as nature cannot be presented as a single theory of

earth. In Book First, *Mr. and Mrs. Glegg at Home*, the narratorial description of St.Ogg's, its history and folklore as pertaining to Saint Ogg himself, gives clues to history in *Mill.* St. Ogg's, "a town "familiar with forgotten years,"[99] is a "continuation and outgrowth of nature" (98) bearing "traces of its long growth and history like a millennial tree" (98). The tree could be the tree of life of the Bible, but also used in Darwin's tree analogy for life on earth; therefore a symbol of "growth", of progression. The town is compared to "nests of bower-birds or the winding galleries of white ants" (98). The commingling of human and animal kingdoms implies revolutionary Lamarckian progressionism, reassessed after *Origin*, but cultural dynamite in 1830s Britain of continental revolution and domestic reform. The animal kingdom figuratively linked to St. Ogg's is exotic and faraway from the fringes of empire. It is the nature of travellers, adventurers and botanists in far-off climes. The "bower-birds" are austro-papuan and "white ants" an Australian term for termites, found in both Africa and Australasia. The local and exotic, human and animal are commingled in an everyday and actualistic manner. Lyell's separation of natural and human worlds allowed for progression of human reason within a nature that is, by implication, eternal; external but not progressive. *Mill* paints a retrospective of human history—if going forward in time—from Romans and Vikings to Saxons and Normans through the "old hall" and then the chapel of St. Ogg, even older belonging to the "ancient town" (98). The latter phrase may infer a binary, almost spatial division between ancient and modern worlds; the kind Jameson used to first dovetail Cuvier and scripture in the 1813 *Essay*. *Mill*, however, constantly strives to unite these two worlds into one. It is the unreliability of the human mind in its knowledge of nature and its narrative fictions that produce divisions in *Mill*. Human narratives, "traditions," are inherently unreliable and incompatible with an actualist approach to nature. The natural world can "tell the truth" through observation of facts and proofs of present and past, i.e. as a system of narrative. But Lyell's actualist approach can only unlock visible causes in the present. Human narrative provides second-hand knowledge of nature; *Mill,* in contrast, strives after an actualist method. The narrator claims to have several "manuscripts" of the history of Saint Ogg and defers to the shortest as "at least likely to contain the least falsehood" (98). Comments on the manuscripts are difficult to interpret as the double use of the word 'least' makes it easy to misread, reflecting the their unreliable (human) nature. *Mill* mediates the skepticism in reading such sources, to be seen as documents or

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[99] Eliot introduces the passage by alluding to Wordsworth's *The Excursion*, which she was reading with "fresh admiration for his beauties and tolerance for his faults"; Haight, *The George Eliot Letters, 421*. It comes from Book First of Wordsworth's long poem *The Excursion* (1814). In the stanza (I. 265-301) the narrator-poet tells of how 'The Wanderer' saves money to buy Milton's *Paradise Lost* to fill "the hollow vale" (I. 280) while "thirsting daily" (I. 284) to "uppermost Nature" (I. 284). The Wanderer measures the "peak/Familiar with forgotten years" which Eliot alludes to in her description of St. Ogg's.

"monuments" and interrogated critically. *Mill* does not produce testable and falsifiable systems that incorporate speculative or theoretical science; theories of the earth are rejected in favour of a new historicism. The whole descriptive passage critically engages with human acts and human sources, while finding truth in the various archaeological remains of the "old hall" and the "original chapel". The remains of human history are stratified like an archaeological dig, "monuments" of the past that can be successfully interrogated in the present. They are far more reliable testimony to the actions of humans than their stories or texts. At the same time, human history grows out of nature, indeed is framed by nature, and therefore is of equal importance in extracting truth from the external world. The dual narrative of human and natural worlds framed in the beginning of the novel allow for progression and change in the human mind, while separating the natural world into a non-progressive flow. However, human systems of narrative are represented as unreliable and therefore unable to represent "truth". Instead, they offer perspective and agency in reordering the natural world.

The story of Beorl son of Ogg, and his ferrying of the Blessed Virgin across the Floss, is treated as "legend". But truth lies in those legends: the legend "reflects from a far-off time the visitation of the floods" (*Mill*, 99) which "swept as sudden death over all smaller living things" (99). The diluvial past and present is united, but St. Ogg's "knew worse troubles even than the floods" (99) in civil war. *Mill* locates a general truth in the veracity of the floods and attendant narrative accounts while characterising the floods themselves as events as plural and as secondary to the extreme ravages of the English Civil War. Human political history is then privileged as a factor driving change. At the same time, this progression in the human world is yoked to the cyclical revolutions of the natural world. Does this presentation of flood events tell us anything about the competing science of the 1830s? Cuvier's proofs of the deluge in *Essay* had been appropriated by Buckland and the diluvialists to shore up Anglican authority by synthesising it with the latest geology. In *Mill* and in the 1830s the commercial success of the Bridgewater Treatises provided an encyclopaedic guide to science and its proper reception in order to avert materialist heresies. But God's glory is not revealed or even observed in *Mill.* It is tempting to point up similarities at a broader level between *Mill's* treatment of floods, history and historicism and Lyell's demythologising new geology based on an actualist approach. The basic critical interrogation of myth and textual documentation as historical evidence may be shared between *Mill*, and, say, *Principles.* Certainly, Mill engages geology, catastrophe and floods. In the natural world of *Mill*, floods and catastrophes are contained by the natural world without ever changing them. Where they do have a profound effect is in the human, individual and internal world. *Mill's* diluvialism is not

that of Buckland and Bridgewater. Maggie is charmed by the resolution and reconciliation of Buckland's Bridgewater Treatise, but in the process, is offered a path to happiness without self-respect or honour. The human "traditions", whether physical like the architecture or textual as the accounts of the history of St. Ogg's, are treated as unreliable historical documents. The revolutions and catastrophes of the past are textually courted and legitimised in the narrator's history. This might be analogous to Cuvier's massive addendum of textual analysis in the *Essay*, where proof of "the last great catastrophe" is found to be plausible, despite the fact that Cuvier had emphasised the local nature of the inundations he had located in the stratigraphic record. *Mill* inhabits similar dissonance.

As Buckland (*Novel Science*, 232), by way of O'Connor, has pointed out, Eliot echoes Cuvier's words from the *Preliminary Discourse*:

> But his ideas change as soon as he seeks to excavate this ground that today is so peaceful, or to climb onto the hills that border the plain. His ideas enlarge, as it were, with his viewpoint. (Rudwick, *Georges* Cuvier, 187)[100]

The sense of perspective pioneered by Cuvier's nineteenth-century masterpiece of natural philosophy is mirrored in Eliot's attempts not to reconcile the mind of the individual and its inherent ability to "burst the limits of time and space". To lift itself up from the "level plain" (*Mill*, 103) and let its "ideas enlarge" does not, indeed, guarantee success in establishing meaning.[101] But Eliot follows Cuvier's "traveler" (Rudwick, *Georges Cuvier*, 187) in locating meaning in a similar threefold scheme of climbing hills, digging down into the earth, and following rivers down their course to "the same final home" (*Mill*, 325):

> They begin to encompass the extent and magnitude of these ancient events, as soon as he climbs the higher chains of which the [foot]hills cover the flanks, or as he penetrates into their interior, following downward the beds of the torrents. (Rudwick, *Georges Cuvier*, 187)

The discrete separation of human narrative and the natural world in Lyell locates progression and "a discernible plan in nature" (Shuttleworth, *George Eliot and Nineteenth-Century Science*, 60) firmly in the human mind. Secord's description of Lyell's *Principles* as "anti-narrative" (*Introduction,*

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[100] Eliot's idea of natural history (see Review of 'The Natural History of German Life', *Essays*, 266-299) is tightly linked to how physical observation and images interrelate giving a person multiple associations with ideas that differ in scale from smaller details to "very expanded views" (*Essays*, 267). This is explored in *Mill* through the movement of scale from "narrowness" to "largeness of mind" (Essays, 29) as expounded in her review of *The Progress of Intellect*. This spatial representation of the universe equates to the forms of natural history and Ruskin's doctrine that "all truth and beauty are to be attained by a humble and faithful study of nature" (*Essays*, 266).

[101] Compare the following from Essays: "Now and then, however, we meet with a nature that combines the faculty for amassing minute erudition with the largeness of view necessary to give it practical bearing; a high appreciation of the genius of antiquity, with a profound belief in the progressive character of human development […] a nature like some mighty river, which, in its long windings through unfrequented regions, gathers mineral and earthy treasures only more effectually to enrich and fertilize the cultivated valleys and busy cities which form the habitation of man." (*Essays*, 29)

xviii) leaves nature without agency and no discernible order except that imposed upon it by human reason and narrative. Buckland claims that an active subversion of story is at work:

> For novelists and geologists alike, there was an intellectual satisfaction to be had in the breakdown of plot, in pauses in its development in which reader and writer were asked to stand back and scrutinize the events related with a dispassionate eye, in the irretrievable piece of missing evidence, in the inability to keep focus on the story because the details kept cluttering up the pace, and in dry disquisition or ostentatiously long description. In my three chapters on nineteenth-century novelists, I see this geological breakdown at play. (*Novel Science*, 26)

Eliot presents a division of human narrative and the natural world in the twin narratives and rivers in *Mill*. Buckland's "geological breakdown" extends, in my reading, beyond the geological context. Geological arguments are used to counteract Lamarckian theory producing progression narratives. However, the privileging of Lyellian actualism in representing "the primacy of individual experience" (Watt, *Rise of the Novel*, 15) locates progression and therefore any discernible narrative in the mind of the human individual.

Lamarckian Morphology

The battle over nature in 1830s Britain took place on many fronts. Science is knowledge of nature: so what science engages and is engaged in *Mill?* The diluvial drama directly interrogates the struggle for hegemony in geology in the 1830s. Buckland's Bridgewater diluvialists continue their struggle to occupy the central space of British science and control its proper use. Geology is to be framed within correct theology. At the same time, Lyell's *Principles* charts a new course for geology in the 1830s. However, his actualist approach relying on present causes presented similarities to Hutton's eternalism. But Lyell separated nature and human reason, allowing for progression only in the latter, while countering historical progression in the former. Historical progression in nature might imply transmutation. Neither Buckland, nor Lyell wanted that. *Mill* is set against the turbulent reform years of 1830s Britain where Lamarckian theories and teachings were actively worked against by those in positions of authority. Shuttleworth claims *Mill* questions "all theories of evolution which imply either some form of progress or a discernible plan in nature" (*George Eliot and Nineteenth-Century Science*, 60) Uncertainty in any chain or scale of beings questioned "man's place in nature", and left radical space for social movement and change. *Mill* provides a complex natural history of provincial folk, full of layers just like Aunt Glegg's drawers. "This puzzlin' world", as Tulliver intones, is not a nature in uproar however; but neither is it in "perpetual decay". *Mill* consistently questions the internal organisational principles of nature through radical inversions and potential pairings such as the roach and the pike. Human characters assume animal characteristics, often, as in the case of Bob Jakin, giving him greater understanding

of society and the natural world. The order or "chain of being" in *Mill* is explored and constantly questioned. Natural theology epitomised by the Bridgewater Treatises in 1830s Britain does provide an organisational model for the world in *Mill*, but cannot explain and contain the plot in its entirety. Lyell's actualism counters their theological arguments in the field of geology but also as a broader, inductive approach. It is nothing new, owing its rigorous empiricism to the Enlightenment and following such British savants such Newton and Bacon. Cuvier employed a similar approach in different times and in a different place. For both Cuvier and Lyell, the separation of human reason is enough to place humanity in a position of rational specialness. Tom seems to bullishly embody "the chain of being" and the dominion of higher beings over lower by firing hardened peas at a "superannuated blue-bottle" (*Mill*, 74). The poor fly may have simply had its time, hence superannuated, so we need not suspect the spectre of Lamarckian morphology here. In contrast, Shuttleworth equates this to a "rationalisation of brutality according to a plan of nature" as characterised by the Bridgewater Treatises and natural theology (*George Eliot and Nineteenth-Century Science*, 61). "Nature," its specialness deserving its capital letter, provides for "for the speedy destruction of this weak individual". (74) Tom's cruelty is validated by his position above the lower and weakened organism; however, his cruelty interrogates the perfect and harmonious design of natural theology.[102] Does Tom have some right and purpose in destroying the weak? What possible teleology could explain Tom's terrible purpose? Instead, *Mill* implies an inversion of the scale of beings, without moral virtue at its human summit.

Mrs. Glegg's watch always tells the same time regardless of others. (*Mill*, 47) The watch analogy presents the Gleggs as creatures governed by narrow-mindedness and firmness of purpose and belief. They embody the resistance to visible and observable facts, and a propensity for sticking to rigid schemes, here those of time, that are old-fashioned and outmoded. They are then unchanging and unlikely able to change. Time, Mrs Glegg intones, runs by her clock, not vice versa. The watch is William Paley's (1743-1805) famous analogy from *Natural Theology* (1802), i.e. a universe infused with God's providence. *Mill* sets the fixity of traditional natural theology against progression and change. Lamarckian radical historical change meets traditional fixity, the fixity of parochial little Britain: "But if the ways o' the family are altered, it sha'n't be my fault; I'll never be the one to come into a house when all the rest are going away." (47) Mrs. Glegg clings to fixity in

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[102] In Chapter V 'Tom Comes Home' the narrator forewarns the reader of the breakdown in the relationship of humans and the natural world: "But that same Nature has the deep cunning which hides itself under the appearance of openness, so that simple people think they can see through her quite well, and all the while she is secretly preparing a refutation of their confident prophecies" (*Mill*, 29)

nature and a scale of beings; her firmity comical. Another point of dissonance in nature is the interchange of race and breed, of the animal and human worlds. Tulliver sets up this disconnection early on in Book First: “That's the worst on't wi' crossing o' breeds: you can never justly calkilate what'll come on't. (11-12) This uncertainty in “the chain of being” raises questions of reading nature, and a personified nature’s own character. Is nature and the external, observable world treacherous and duplicitous? In Book First, the narrator forewarns the reader of the breakdown in the relationship of humans and the natural world:

> But that same Nature has the deep cunning which hides itself under the appearance of openness, so that simple people think they can see through her quite well, and all the while she is secretly preparing a refutation of their confident prophecies. (29)

This narratorial statement implies that scientific proofs, or “facts” after our original Buffonian model, will overturn “traditions”. The use of refutation may point to correct context. Are humans so removed from understanding of nature in a precarious position? Or is this perhaps the natural state of things. The confident prophecies implied seem to be theological systems. The “refutations” may refer to “monuments,” as in fossil finds, that had completely upturned human understanding of nature by the 1830s. This paragraph is, of course, about protagonist Maggie, though this narratorial generalisations inferred from a particular case engages nature in *Mill.* Any “system” in the taxonomy of the human and animal kingdom in *Mill* collapses. This inferred generalisation about nature is soon followed by further inversions of lower and higher forms: “We no longer approximate in our behaviour to the mere impulsiveness of the lower animals, but conduct ourselves in every respect like members of a highly civilised society.” But Maggie and Tom behave like “young animals” (34). Separation followed by commingling; human specialness is preserved by both Lyell and the diluvialists. *Mill*, in contrast, subversively intertwines and morphs lower and higher forms, possibly implying a unity of composition that could allow characteristics and features to flow freely between any two organisms. At other times it adopts a more functional teleology such as Maggie’s “inflexible purposes” and “unmodifiable characteristics” concealed beneath her exterior physiognomies (29). Bob Jakin, Tom’s childhood nemesis and rough sort, similarly epitomises the discordance between observable, external features and internal characteristics. Cuvier’s functional anatomy worked from the inside out and inferred the internal organisation of anatomical features outward to external habits and habitats. Bob Jakin defies such logic; one wonders what reconstruction might be made from his anatomical remains—possibly quite a different creature. Bob Jakin is described “like an amphibious animal who foresaw occasion for darting in” (42). He is transported down the scale of beings, or across *embranchements* in functional anatomy, or through the unity of composition in philosophical anatomy, to another form, and yet his

connection to the natural world is acute and includes foresight that seems entirely lost in *Mill's* human characters. Amphibian characteristics, whether analogous or homologous, are figuratively transposed onto the human, and the results of such behavioural transmutation are positive.

Uncle Pullet inhabits similar confusion "in the maze of this puzzling world" (*Mill*, 60), the narrator echoing Tulliver's refrain. Uncle Pullet belongs to an "extinct class of British yeoman," that could not imagine "the British constitution in Church and state had a traceable origin any more than the solar system and the fixed stars" (59-60). There is no need for Pullet to question accepted and received wisdom. Stability is all that matters in a world without origins; historical accounts of earth history and the universe are irrelevant. It may well rad as yet another jibe at the Bridgewater natural theologians, in this case Whewell's *Astronomy and General Physics* (1833). However, the contention that such yeoman are extinct also implies comic treatment and irony. Cuvier's proofs of extinction were used to support diluvialist accounts and creationist politics. This then reads as an oblique joke at the expense of the theologians: extinction questioned the fixity of species and the specialness of creation—to then use it as proof of the very thing it disproves is, indeed, impenetrable. They must be thankful for salt-of-the-earth Pullet-types who demonstrate the natural stoicism to accept without question. The narrator charges us to "reflect on the remarkable results of a great faculty under favouring circumstances", adding that Pullet had "a great natural faculty for ignorance" (60). She juxtaposes a progressive narrative of earth history where change can be effected against a vision and imagination that cannot transcend its own boot laces. The scene closes with the theme of confusion in the natural order: "in the maze of this puzzling world" (60).

Disconnection in the physical world finds expression in natural aberrations. Or perhaps like Geoffroy's monstrosities in his 1820s argument for transmutation against Cuvier, they are a fast track to change. Geoffroy posited gross deformity resulting from catastrophe or sudden and violent change as a driver of progression in organisms. Pullet's stoic puzzlement is followed by a comic juxtaposition of religious leadership and physical deformity. Discussing "hump-back" Philip Wakem's future Mrs. Pullet declares it "natural" to send deformed son, Philip, to be a clergyman for an education as he'll not have a trade. Could Wakem be an example of Geoffroy's aberrations or monstrosities? It questions the very idea of natural theology where perfection in nature is evidence of God's presence in creation. Cuvier's law of the correlation of parts in his functional anatomy proposed the same integral organisation without the need for divine agency. What then is a deformity? To what purpose? Only Geoffroyan anatomy, and particularly his palaeontological work aimed at refuting Cuvier, allowed a critical role to deformity and monstrosity in effecting sudden

change. In Book Second, Tom ties deformity to the moral rascality of Wakem Senior. But Philip Wakem's is not a "congenital hump" but caused by a tragic childhood accident. Birth over habit or habitat: Darwin over Lamarck. (134-5) Philip's deformity awakes both fear and revulsion; and yet the aberration in nature has a power over the first-born son. Tom does not have recourse to anatomical knowledge and hence has to rely on persisting, folkloric understanding that leaves him in fear of nature, and, moreover, powerless to control it. Again, nature is a confusion of human understanding. Cuvier's comparative anatomy unlocked geology and a broader understanding of how the earth works, doing away with speculative theories of the earth. *Mill* continues the highlight similar issues of internal and external understanding of nature and of humans. Palaeontology and comparative anatomy, Cuvier's two legacies, provide models for understanding exteriors through knowledge of interiors; in short, new kinds of "revealed" truth.

Mr. Glegg's activities as amateur naturalist provide "a double source of mental occupation" described as "inexhaustible" (*Mill*, 101). *Mill* lampoons the misdirected amateur naturalist and associates him with the tragically misdirected arsonist and Wesleyan preacher, John Martin. The reading of "zoological phenomena and the great events of the time" (102) resonates with our contested scientific spaces, and further the relationship of natural and human worlds. Several things are being mocked: first, the search for unity of meaning whether scientific or religious, in fact on any level. Just as Tulliver cannot make sense of a "puzzling world". Glegg synecdochally links "great and small" (q.v.) just as science tries to infer laws out from experiment to real life, and how readings of current events were constantly evaluated in terms of scenes or passages from the Bible. The interposing of "caterpillars, slugs, and insects" (102) with "great events" is highly comical and yet tragicomic in that it provides for a free associative interpreting of anything, at any point in a scale of natural order. It both implies a structure and unity in nature that could spiral out from small to great, from the simplest of beings to the most "advanced" i.e. in a scheme of politically volatile transformation, while simultaneously satirising, as an associative leap of faith, superstitious eyes finding the supernatural in the unexplainable. Mr. Glegg does not understand the order of things; he is confronted by confusion in the natural world and political history. The relationship between nature and its inhabitants confuses even those in seats of learning. Stelling, to whom "teaching came naturally" and is "under the immediate teaching of nature" displays "uniformity of method and independence of circumstances" (115) that seem to undermine any progressive logic in a scheme of development. The subtext again is that Lyell's actualist method is the natural one, superseding that of the genteel clergymen in Buckland's camp. Broderip's account of the "amiable

beaver" published in *Gardens and Menagerie of the Zoological Society* (1831), building a dam on the third-floor of a London house, displays either a) a creature fulfilling its function regardless of environment (if placed there by people), or b) an animal trying to adapt to its environment. The account was published in 1831 and the "amiable beaver" came to London in 1825. That puts the narratorial voice into the 1830s and very much in context, supporting the thesis that the book can and should be understood in its 1830s setting. Another of *Mill's* pairings is the roach and the pike:

> The roach necessarily abhors the mode in which the pike gets his living, and the pike is likely to think nothing further even of the most indignant roach than that he is excellent good eating; it could only be when the roach choked him that the pike could entertain a strong personal animosity. (207)

The interaction of species through functionality is compared to personal relationships in humans. *Mill* questions classification and explores "conditions of existence" (after Cuvier) in terms of *transmutation* or *morphology*. *Mill* shifts from a functionally integrated world to one where the individual revolts through private experience and relationships beyond mere typology. The roach and the pike cease to be symbols of their species, race or type and interact in "strong personal animosity" (207) but only through minor catastrophe i.e. the pike choking on the roach. Typologies and classifications constrain and confuse understanding in *Mill.*

A fixity of nature and characteristics is interrogated in the figure of Lawyer Wakem, Mr Tulliver's nemesis who cruelly ensures his eventual demise. The relationship of human and nature, the interaction is in the "stepping stones" through "muddy bits of practice" (207). Images of stones and mud point up geological relationships. The reprised call of "Wakem was Wakem" (207) again plays on type. It could play on "waken" because he is an opportunist, a scavenger, a survivor. Organic conceptions of nature, as prefigured in Cuvier's "law of the correlation of parts", provide a different kind of fixity then the traditional model of the scale of beings. But functional anatomy retains a fixity of purposiveness that persists in the absolute character of the maligned law practitioner. But an organic unity of plan or composition reflecting Lamarckian and Geoffroyan philosophical anatomy, in contrast, resists static, residual characterisations. Wakem is not "uneasy," nor does he feel "hate," seeing Tulliver as a "pitiable, furious bull entangled in the meshes of a net" (208). Wakem's tricks are part of their "conditions of existence" that might allow an empiricist to divine their relationship:

> He was given too observing individuals, not to judging of them according to maxims, and no one knew better than he that all men were not like himself. (209)

Wakem's ability to judge according to empirical evidence and not generalised typologies gives him advantage, but also a thoroughgoing vision of individuality and specificity. At the same time, he favours his deformed son, Philip. Moreover, his later kindness turns this simple typology on its head. Wakem may be one of few characters that experience freedom to break away from inherited patterns and relationships in the natural order. Movement and change throughout taxonomies, and internal morphology is possible through a number of factors in *Mill.*

Summary

The repositioning of focus to 1830s Britain has reformed *Mill* and Eliot's attempt to chart a course through a very thorny cultural present. The narratorial structure engages with Lyellian actualism and the uniformitarian geology of *Principles*. This is not done by importing a plot wholesale; instead, the narrator engages the same context, the same contested space of science, the same rhetoric and debate. *Mill* becomes a narrative exercise in resolving various claims about the natural world. They are all, however, mediate through a system of human narrative that is unstable and unreliable. This is compared to both Secord's categorisation of Lyell's *Principles* as "anti-narrative" and Buckland's argument of novelists and geologists using "geological breakdown" as an active and subversive strategy. We read a different Cuvier in different circumstances and incorporated by different historical actors with different agendas. The homogenising brutality of natural theology acts as conservative force that initiates the catastrophic flood story. At the same time, Cuvier inhabits the Lyellian actualist approach that incorporates catastrophe from fabulous past into a very real present. Moreover, Cuvier might both resist and produce Lamarckian science stories that introduce progression into the natural world and chain of being. The unresolved confusion over typologies and taxonomies is a superimposed understanding and misunderstanding of issues of progression in nature. At the broadest level the figure of the flood and the twin rivers produce a Lyellian theory of the earth. When finally the Floss awakens the deluge delivered is not Cuvierian proof of a divine hand. Even Bridgewater implies a tenuous pun on the veracity of natural theology's proofs of providence in nature, as well as a cruel and brutal hand in regulating the worlds of individuals.

9 The Last British Cuviers: Grant and Owen

This study has discovered different Cuviers in different times and different places. Britain in the eighteen-forties and into the early 1850s provides another context and yet another nuanced evidence base. The publication of *Vestiges* (1844), a subject that has been ably covered by Secord (*Victorian Sensation*), and then the return of the spectre of revolution in 1848 suggest the decade incorporated a narrative of progression. The need for science to revoke the materialist account of nature that implied historical progression and Lamarckian change was therefore acute for existing power elites. The struggle to suppress revolutionary forces was fought both on domestic and international battlegrounds. But both fronts were increasingly focused on palaeontology and comparative anatomy, culminating in the apex of British nineteenth-century commerce and science in Owen's engineering of the anti-progressionist dinosaur at the Great Exhibition. Yet again, Cuvier was central to the paleontological dust-up between competing practices and historical actors. At the heart of these cultural debates in British science were two men vying for the title of "British Cuvier", Robert Grant and Richard Owen.

Robert Edmond Grant (1793-1874) became the London University's first professor of comparative anatomy, having taken the Chair of Zoology in 1827. Grant had practiced as a physician in Edinburgh from 1815 to 1817, afterwards visiting the *Muséum* in Paris and returning at regular intervals. Desmond writes: "Grant was initially successful in London. Edward Turner, brought down from Edinburgh to take the chemistry chair, actually hailed him as the future "Cuvier of this country." (*Grant: A Pre-Darwinian Transmutationist*, 203) The *Lancet* dubbed him, rather amusingly considering his Scottish provenance, as "the English CUVIER" (203). Desmond warns us however that, yet again, rhetoric fails to deceive and he attributes flattery to "internecine feuds" (203). Grant's inaugural lecture as professor of zoology included a scathing attack on "English catastrophism" (Desmond, *Politics*, 66). Grant knew Cuvier personally from his time in Paris, and this perceived schism is really only from English catastrophism as embodied by the diluvialists of the Bridgewater movement and their project to dovetail Cuvierite mechanism and observations with a theological agenda. Grant's *Outline of Comparative Anatomy* (1835-41) was available in cheap paperback form and taught a progressive Lamarckian chain in the fossil record and the history of life. Desmond strikes a note of admiration: "Grant was uncompromising, courageously so, and largely supported by reformers and radicals. In a sense, his real place was

Paris" (*Archetypes and Ancestors*, 118). His zoology owed more to Geoffroyan philosophical anatomy than Cuvier's functional, teleological approach. Desmond notes that Grant was tipped as "the English Cuvier" (*Grant*, 203). But, after darling of the Anglican, conservative clerisy and one-time intimate, Richard Owen (1804-1892) vetoed his receiving of a post at the Zoological Society, Grant's career continued in a downward spiral. By the 1840s he was facing extreme financial hardship and his scientific output dwindled. Grant was subsequently written out of the Darwinian account of evolution in Britain. Historians of science such as Desmond and Secord, however, are now re-voicing Grant in that narrative and promoting Grant studies.[103] As a result, the grand science narrative is altered as lost voices are lifted up and rich heterogeneity restored. Grant's part in the development of pre-Darwinian models of evolution, in turn, shows Cuvier's continued role and significance in British science and its stories in the narrative systems of British literature.

Richard Owen (1804-1892) was the son of a middle-class merchant family. He attended Edinburgh University 1824-25 before completing an apprenticeship at St. Bart's in London. He assisted the conservator with the Royal College of Surgeons' Hunterian Collection, and was appointed to catalogue them by the Council in 1830, an undertaking he fulfilled for twenty-six years up until 1856. Owen's work came under fire during the 1830s. *The Lancet*, known for its Lamarckian sympathies, publicly criticised Owen's Cuvierite cataloguing of the collection, following *The Animal Kingdom's* functional division into four fixed *embranchements*. Owen filled the Hunterian with fossil finds: the *mylodon* and the *iguanodon*, and the extinct *moa*. Conlin describes Owen's work at the Hunterian as a "Peelite agenda of steady reform, avoiding the 'vortex' of notorious French theories of transmutation and raising the profile and prestige of British natural history" (57). In short, Owen was an establishment man. Desmond (*Archetypes and Ancestors*, 118-19) underlines the fact that he "guided his research along lines which reinforced the status quo". Owen's greatest coup in countering Lamarckian progression was the "invention" of the dinosaur. Owen shoehorned Buckland's "great lizard" or *megalosaurus* and Gideon Mantell's (1790-1852) *iguanodon* and *hylaeosaurus* into a new fossil order called *dinosauria*. Effectively, Owen removed the *megalosaurus* from lesser reptiles to counter progressionist schemes. The new *dinosauria* were "relaunched" at a British Association for the Advancement of Science meeting in 1841. Owen turned the *megalosaurus* from a progressionist lizard into a mammalian pachyderm and

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[103] Desmond, "Designing the Dinosaur: Richard Owen's Response to Robert Edmond Grant.", *Archetypes and Ancestors : Palaeontology in Victorian London 1850-1875*, "Richard Owen's Reaction to Transmutation in the 1830's.", "Robert E. Grant: The Social Predicament of a Pre- Darwinian Transmutationist.", *The Politics of Evolution : Morphology, Medicine, and Reform in Radical London*; Secord "Edinburgh Lamarckians: Robert Jameson and Robert E. Grant."

placed it next to mammals on a scale of life. This constituted degeneration akin to the 1790s model worked on by Geoffroy and Cuvier. Indeed, Lamarck's original models had used this anti-progressionist directionalism. The Crystal Palace dinosaurs pay tribute to Owen's enduring success. Another "pragmatician" in the Cuvier mould, he effectively donned the mantle of the British Cuvier, honouring his progenitor at the famed "Dinner in the Belly of the Iguanodon".

With the broad acceptance of uniformitarian models of earth history through the forties and fifties, the special status of humans as separate to its problematic and eternalist time scheme required continued boundary work in countering forces for reform and, post-1848, revolution. Owen's championing of Cuvierite functional anatomy, initially privileging function over form, changed subtly through the 1840s and onward. Influenced by German *naturphilosophie* and its view of the organic unity of the universe, Owen developed his own version of a philosophical or transcendental anatomy; one that would have been anathema to Cuvier. But in stark contrast to Geoffroy's morphology of homologies between different forms, allowing species transition, Owen's new anatomy was based on archetypes or forms, reminiscent of Platonic ideal forms. This transcendentalism was a marked break from the strictly functional and teleological anatomy Owen had used to counter Geoffroy. Levine (*Darwin and the Novelists*, 127-128) has drawn attention to essays in *Household Words* expounding Owenite transcendental biology or idealist anatomy, but these texts, however, date to the late 1850s and on.

Charles Dickens (1812-1870) has been the focus of literary criticism based on geology before.[104] It has variously been argued that his work both does and does not have a clear relationship with science, evolutionary biology and more recently Secord's "anti-narrative" and Buckland's "geological breakdown". The inability of critics to characterise Dickens' interactions with science is most likely indicative of his own ambivalence to its dehumanising mechanisation contra its epistemological opportunities in understanding the universe and natural world.[105] I argue that there is a relationship between Dickens and Cuvier that points to interactions in their work. However, those interactions in the 1840s incorporate the competing science stories of both Grant and Owen. Moreover, I suggest that there is a relationship between anti-Lamarckian science stories from 1840s Britain based on Cuvier's work. These science stories were driven by one man, Richard Owen. I have suggested links between the realist serialised novels of George Eliot and both

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[104] Levine, *Darwin and the Novelists : Patterns of Science in Victorian Fiction*, Turner, *Mechanism and the Novel : Science in the Narrative Process*, Zimmerman, *Excavating Victorians*, Buckland, *Novel Science Fiction and the Invention of Nineteenth-Century Geology*.

[105] Turner, *Mechanism and the Novel: Science in the Narrative Process.*

scientific method as novel, and in representing nature according to primary science discourses in 1830s Britain: diluvialism, Lyellian actualism and Lamarckism. All of these discourses interact with Cuvier. The question I will put here is whether Owen's transcendental anatomy based on Cuvier might have a relationship with the Dickensian novel.

Reconstructing Narrative in Dickens

Buffon's *Natural History* in eight volumes is inventoried among the contents at 1 Devonshire Terrace, May 1844.The books also contained a copy of *The Deluge: A Poem* (anon.).[106] These sparse interactions with geology have been interpreted as reflecting the reading interests of a Victorian man-of-the-world.[107] Moreover, that Dickens' interactions with geology are defined by a lack of overarching system and a commitment to the "mystery" of life. This lack of overarching system incorporates Secord's "anti-narrative" and Buckland's "geological breakdown" in an unstable system of narrative that cannot resolve issues of telling "true history" or even of discriminating between fact and fiction.[108] Moreover, I argue that Dickens's geological perspective incorporates and contains an anatomical mystery that fails to resolve itself into either Cuvierian functional teleology or Owenite idealist and archetypal biology.

Cuvier is one of the most featured naturalists in Dickens' various journals and publications, in both fact and fiction. Levine (119) argues in *Darwin and the Novelists* "Even his [Dickens's] "catastrophism," with its implicit recognition of progressive change rather then Lyellian stasis, belongs to Darwin's world, for, as I have suggested, Darwin's achievement was in part the absorption into uniformitarianism of catastrophist progression." Levine traces Darwin back into *Bleak House*, the assumption being that pre-Darwinian evolutionary models permeate Victorian culture. Indeed, *Bleak House* does intersect with significant proto-evolutionary theory and narrative. But I argue that the geological frame of the novel is predicated upon its anatomical and palaeontological centre, shifting critical focus to the 1840s. Moreover, I argue that Cuvier is central to those debates through the science practitioners and historical actors of the 1840s that constitute the actualist present of the story as temporally initiated and played out in Esther's narrative. I propose that the interaction of a diversity of pre-Darwinian models are present in *Bleak House.* Moreover, I suggest that Cuvier is central to those anatomical and geological debates. It follows that a more detailed and nuanced historical evidence base changes the overarching account of science.

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[106] Dickens, *The Letters of Charles Dickens,* IV, 711.2.

[107] See Metz, "Science in Household Words: "The Poetic...Passed into Our Common Life".

[108] McKeon, *Theory of the Novel*, 384-5.

Levine's commingling of Dickens and Darwin is displaced, instead emphasising a variety of proto-evolutionary practices and practitioners in the 1840s. As a result, Cuvier's role and significance in British scientific debate and science-infused novels is re-energised in respect of *Bleak House.*

This relationship can be investigated and explored through Dickens' various publications and writings. From humorous anecdotes to fictional serialisations to scientific meditations, Cuvier is a constant in Dickens' world. Several critics[109] argue that the secondary sources of reviews and journals cannot reliably represent Dickens's own views. But his world contains science, geology and, as examined above, Cuvier.[110] I shift focus from Dickens' authorial intention to the scientific context of *Bleak House.* Critical debate originally centred around the uniformitarian-catastrophist paradigm that Levine, Beer et al. as a precursor to Darwin and evolutionary biology. Cuvier studies, in contrast, has a point of departure in comparative anatomy and the law of correlations. In other words, anatomy and palaeontology are privileged over geology; the former initiate change in the latter. Buckland in *Novel Science* (2013) represents the vanguard in reassessing the uniformitarian contra catastrophist geological dichotomy proposed in Beer and Levine. Buckland shifts emphasis to questions of narrative. Does geology produce or resist plot? Previous positions of organisational and structural affinities have been replaced by less harmonious interactions that produce problems for plot rather than models. I argue here that anatomical and palaeonotological debates further complicate scientific stories and interactions. Moreover, I suggest that the putative search for truth in *Bleak House* occurs through reconstructive models that attempt to produce meaning through anatomy not geology. Where geology offers "anti-narrative" or sites for "geological breakdown", anatomy and palaeontology produce plots of reconstruction. Dawson highlights Cuvierian method as the basis of Owen's palaeontology, that in turn produced a reactionary narrative reaffirming the status quo:

> What had once seemed merely incongruous, ungainly, and awkward, was now instead revealed as an instance of harmonious and perfectly integrated design, and it is hardly surprising that Owen's paleontological feats were welcomed as indisputable affirmations of natural theology. ("Literary Megatheriums", 208)

Bleak House demonstrates affinities and interactions with Cuvier in its historicization of the earth and split narrative. Together, these explore connections and disconnections from geological time and space, leaving the denizens of the novel "bewildered". Buckland argues that the initial episode

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[109] Drew, *Dickens the Journalist*, 106; Lai, "Fact or Fancy: What Can We Learn about Dickens from His Periodicals "Household Words" and "All the Year Round"?", 41; Drew and Lai argue that Dickens views on science cannot ably represent his attitudes to and intentions regarding science in his novels.

[110] See note 5.

from *Bleak House* could represent both uniformitarian or catastrophist plots; but that the episode does not show an overarching story, but a localised one, and one that most geologists would agree on. Similar to the diorama[111] it tells a single episode, not a plot or theory of earth. However, rather than countering Levine and Beer's use of Darwinian models, Dawson looks to another tradition of literary criticism that shifts focus away from the intersection of Darwin and the British geological rhetoric that juxtaposes catastrophist and uniformitarian understandings of earth history.

> The skeletal structure of the Megatherium and other instances of perfect functional integration in prehistoric megafauna afforded an organic model for the underlying unity of nineteenth-century fiction that was no less pervasive or effectual than Darwin's web of complex affinities, and which, unlike the now more familiar Darwinian plots, was especially attuned to the novel's prevalent mode of publication in this period. ("Literary Megatheriums", 228)

Buckland agrees that "men like Charles Dickens and the comparative anatomist Richard Owen, for instance, in restructuring the earth as a commercial spectacle, transformed themselves into commercially successful giants on the urban stage" (22). Buckland (*Novel Science*), however, implies in her readings of Eliot that absence of plot can in and of itself be a form of emplotment or plotting. The flood, for example, Buckland identifies as a narrative device to remind the reader of "potential seductions of "silly" stories" (238). Catastrophe and its geological namesake catastrophism might counterbalance the entropic and decaying spatial world of *Bleak House* in similar ways. The active pursuit of geological breakdown as described by Buckland, I argue however, produces only the outer and broader frame of reference for *Bleak House*. That collapse and chaos is tangible, but its geology is predicated upon Cuvierian palaeontology. In some ways, it seems a given that the outer worlds of *Bleak House* are inevitably either in stasis or in decline into chaos and breakdown. But the internal and inner directionalism of progressive pre-Darwinian biology provides the dynamic movement of plot and hence the site where narrative might be able to provide "true history" and progression. It is therefore the textual reconstruction of Esther that might empirically address truth and therefore understand the world.

Critical debate persists about the use of science and narrative in Dickens. Buckland (27) approaches Dickens from a wide, comparative perspective, looking at the three "transitory novels" of *Dombey and Son*, *Bleak House* and *Our Mutual Friend,* claiming the writer "stages urban chaos and fragmentation as a geological spectacle". Buckland draws on Hill's "Books That Dickens Read" (1949) to claim that natural history was the "most well-represented branch of science on his bookshelves" (248). Hill characterises this as simply "intelligent interest […] expected of a man of the world" ("Books That Dickens Read", 203). Buckland also draws on Nancy A. Metz'

'Household Words: "The Poetic. . . Passed into Our Common Life"' from *Victorian Periodicals Newsletters* (11.4, 121-133) which questions accepted wisdom about Dickens having little or no interest in science, quoting Haight's contention: "there is scarcely a trace in his novels of the new theories that revolutionised man's view of himself and his universe in the nineteenth century".[112] In terms of both reading (after Hill) and production in his periodicals *Household Words* (1850–1859) and *All the Year Round* (1859–1881), Metz (123) writes, "Much of what we consider 'Dickensian' reflects this energetic curiosity, this living interest in what makes it tick, in the mechanics and inner life of everything from a stethoscope to a sawmill." Several critics[113] argue that the secondary sources of reviews and journals cannot reliably represent Dickens' own views. What is unequivocal is that Dickens' world contains science, geology and, as examined above, Cuvier. These relationships do not have to be overtly and explicitly indicated by the author. In fact, as Beer argues in *Darwin's Plots* (2), they are far more powerful as "assumptions embedded in the culture". By separating Dickens's own reading practices and intention from the story of *Bleak House*—in other words, by focusing on narrative and not historicist or formalist approaches—I suggest *Bleak House* can be successfully read outside of its traditional Darwinian frame of reference. Moreover, I agree with Dawson that anatomical and palaeontological science provides an effectual model in understanding Victorian serialised reading practices:

> […] inferences from serial installments assumed an unerring relation between part and whole that closely paralleled the understanding of anatomical structure that enabled paleontologists like Owen to wield the "prophetic power" of Cuvier's "principle of palaeonotological research" in their own inferences from fragmentary bones—and Owen's description of this prophetic power itself appeared in a serialized work. ("Paleontology in Parts", 666-667)

Intersections of geology and literature, their intertextualization, become problematic in Dickens criticism. Buckland berates Zimmerman because she "sees geology as a spur to narrative, and my aim is to show the places in which geology was a problem for it" (322). Buckland's critique seems to similarly undervalue the writers' own assertions that science cannot fully describe life's mysteries. However, Dawson suggests an alternative model for narrative complementary to Buckland's "breakdown" and Secord's "anti-narrative". Just as Cuvier claims fossils are key to understanding earth history, so too might they provide a useful approach to reading and analyzing nineteenth-century fiction.

As Dawson and Lightman point out, one recurring issue is "to eschew — as far as is practicable — convenient but often misleading modern terminology and instead pay greater

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[112] Haight, "Dickens and Lewes on Spontaneous Combustion".

[113] See note 7.

attention to the actual language used by the Victorians themselves" (x). History and sociology of science differ from literature and science studies in this respect, they argue. Dickens, in his review of Hunt's *The Poetry of Science* in *The Examiner*, for example, does not seem to echo Buckland's thoughts in this matter. In fact, though Dickens speaks of "philosophers", he himself follows the narrative which geology unravels in rolling prose. Does he then identify and explore geology as a site for dramatic and narrative breakdown? Or does he engage it rather "as a spur to narrative"? Buckland circumvents this question of textual exegesis by widening the net to include a "range of sites in which "science" took place" (248). Buckland moves away from Levine's emphasis on implicit structural patterns (in his case in the worlds of Dickens and Darwin),[114] and privileges "visual and structural science" (248), after O'Connor.[115] Dickens' familiarity with these kinds of spectacular reconstruction do seem to permeate *Bleak House*. Buckland points out that "verbal recreations of panoramic scenes from deep time abounded in geological writing" (248). Dickens employs similar techniques in *Bleak House* from the outset. The opening scene recreates a "double-effect" diorama, where two scenes are superimposed and mutate into one another. Fog allows transition, implies a deep-time retrospective in visualising the *megalosaurus*, and the scene, beginning with the Lord Chancellor in Lincoln's Hall Inn, segues back to him "with a foggy glory round his head" (*Bleak House*, 6). The lanterns outside, where his attention rests, by a trick of the light, mean "he can see nothing but fog" (6). The scene continues with various references to lighting: "the court may be dim", "the fog hang heavy in it", "the attendant wigs stuck in a fog-bank" (6). The panoramic sweep through the medium of fog draws the eye up and down river: "Fog on the Essex marshes, fog on the Kentish heights" (5). In conclusion, Dickens leads the eye in a descriptive journey around a panorama of London. "Fog is everywhere." (5) It binds everything together at the same time as allowing the eye to travel through space, and even in time. The superimposition of scene upon scene through the medium of fog and light evokes a diorama. Geology as spectacle frames *Bleak House.* But it is "fossils alone" that produce any narrative in earth history, and therefore the anatomical and palaeontological scientific debate that provides a basis for narrative creation, rather than narrative breakdown.

> How was it not seen that the birth of the theory of the earth is due to fossils alone; and that without them we would perhaps never have dreamt that there had been successive epochs, and a series of different operations, in the formation of the globe? (Rudwick, *Georges Cuvier*, 205)

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[114] Levine, *One Culture*; Levine, *Darwin and the Novelists: patterns of Science in Victorian Fiction*.

[115] O'Connor, *The Earth on Show*. See Lightman, *Victorian Popularizers of Science* (2007, 167-218) for the "pictorial" in British science.

Skeptical Empiricism and Satirical Science

Dickens deploys science as comic relief in a mocking and parodic tone. In this sense, his narrative tone extends beyond McKeon's "naive empiricism"[116] and embraces an ironic skeptical empiricism critiquing the novel as unmediated truth. Instead, Dickens plays on this very issue of reliability and unreliability of human narratives of science. In *Full Report Of The First Meeting Of The Mudfog Association For the Advancement of Everything*[117] and *Full Report Of The Second Meeting*,[118] for example, Dickens satirises the association mercilessly. This is a clear jibe at the British Association for the Advancement of Science, where Owen relaunched the *megalosaurus* as dinosaur in 1841. The epithet Mudfog evokes the bumbling Professor Dingo, and *Bleak House* where Dickens depicts London from the mists, fogs and mud of its primal provenance. Dingo inhabits a comic periphery as a former Mr. Badger, "an eminent scientific man" (*Bleak House*, 206). Mrs. Badger's former husbands stratify her existence like geological rock formations. Mrs. Badger herself "has had the rare advantage of being formed by two such very distinguished (I will even say illustrious) men" (207). Buckland (266) affirms that *Bleak House* "repeatedly returns to the language of geology," and her contention that geology only creates problems for narratives agrees with Dingo's peripherality. Indeed, geology never plays a part in solving *Bleak House's* mystery. It only presents problems and distractions. Geologist Dingo may well be a sly allusion to Reverend William Buckland's famed Kirkdale Cave find, also known as The Hyaena's Den. Professor Dingo and Mrs. Badger had, of course, stayed in North Devon after their marriage — where else would a geologist go — where "he disfigured some of the houses and other buildings by chipping off fragments of those edifices with his little geological hammer" (207). In his passing, Dingo even "insisted on keeping his little hammer under the pillow and chipping at the countenances of the attendants. The ruling passion!" (207) cries the current Mr. Bayham Badger. Buckland summarises: "The practice of geology was obsessive to the point of imbecility, the story implies, but it was also comfortingly concrete" (12). The practice of gentlemen geologists is lampooned; moreover, their very method as empirical science is called into question, and, in turn, their ability to produce a meaningful narrative.

This discontinuity in human narrative needs unpacking. The name dingo juxtaposes geology and zoology. If *Bleak House* privileges anatomical over geological narratives as a method of

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[116] McKeon, *Theory of the Novel*, 384.

[117] Dickens, *Bentley's Miscellany*, II, 397-413.

[118] Dickens, *Bentley's Miscellany*, II, 209-27.

enquiry into truth, then Professor Dingo stands at the intersection of these two disciplines. Dickens discusses the Dingo in 'Four-Legged Australians' (*Household Words* VII, 208-14) in April 1853. The dingo inhabits a space between feral wild animals and the domestic dog. There is a juxtaposition of, on the one hand, an obsessive academic at the hub of "Scientific Exchange" where there is "science to an unlimited extent" and, on the other hand, "the great stone book which is the history of the earth" (*Dickens Journal* II. 132). Both imply vision, but Professor Dingo — the wild dog — also has an intense focus on the very near, at which he chips away continually with his comical geological hammer. Can he see the wood from the trees? Dingo embodies a scale slide from domestic to wild, from near to far, from the present to the ancient history of the earth. Mrs. Badger's three husbands — sea-captain, geologist, physician — retrospectively produce her history and current nature like a stratigraphical cross-section. They imply ages of "man's place in Nature"; his mastery over geography through travel on the seven seas, geology through excavating said geography, and finally biology in Bayham Badger's medical practice. The geologist in *Bleak House* provides comic relief. In contrast to Richard Carstone, however, Dingo has his "romances of geology and of the animal world" (*Household Words* II, 278) — a ruling passion that Richard never finds. The figure of the scientist is not central to plot in *Bleak House*, supporting Buckland's thesis of "geological breakdown". However, the world of *Bleak House* — its "vast worlds of wonder" — are nevertheless filled with a skeptical analysis of the language and method of geology.

The claim that the *megalosaurus* was both "just one of the many", perhaps even a household name, and a part of a broader geological tradition that was engaging the extended earth history being put on show in Victorian society does not detract from its very otherworldliness and its representing a wild romance inherent in geology.[119] However, the contradiction in terms of its alleged mundanity, its "wonderful" character (5), I argue, should be refocused to anatomical debates between Cuvierite and Geoffroyan anatomy as reinvented by Owen and Grant. The positions of Buckland and Turner, between the *megalosaur* as an everyday detail of the period and an image that cannot be processed, needs reconfiguring to admit the historical context of Owen and his creation of the pachydermal dinosaurs. Zimmerman is not surprised by a "prehistoric beast in Dickens's idiom" explaining that "artifacts, ruins, and traces of the past corrupt the experience of the living in the present and render stagnant the hope of progress toward the future" (143). The image of the *megalosaurus* so casually drawn to mind by the third-person narrator makes the fossil monster at once very ordinary, and yet at the same time extraordinary. The movement implied is indicative of a

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[119] Buckland cites Turner, *Mechanism and the Novel*, 97. Turner describes the *megalosaurus* as an"incommensurable image".

geological worldview inscribed in all our novels, based on movements in space and time and signalling a cosmology capable of being rapidly expanded and contracted to a new vision of earth history. But the subtext of the *megalosaur* is palaeontological; it is a construct conceived to counter Lamarckian anatomy and Geoffroyan morphology as expounded in Britain by Grant.

The intertextuality with various stories and accounts in *Household Words* has been noted by Buckland (*Novel Science*). The *megalosaurus* appears in the Phantom Ship series published in *Household Words.* Henry Morley's 'Our Phantom Ship on an Antediluvian Cruise' takes us on a virtual tour of geological worlds and times at the centre of which stands the beast from Dickens' *Bleak House*:

> Here is a land reptile, before which we take the liberty of running. His teeth look too decidedly carnivorous. A sort of crocodile, thirty feet long, with a big body, mounted on high thick legs, is not likely to be friendly with our legs and bodies. Megalosaurus is his name, and, doubtless, greedy is his nature. (*Household Words* III, 494)

Henry Morley emphatically trumpets Cuvier's trope "to burst the limits of time" as the phantom ship traverses "three great periods" that are not "breaks in nature, but in human knowledge" (*HW* III.493). Geology implies then a narrative of human understanding, but one akin to Lyellian actualist geology where human reason imposes narrative progression on an ahistorical natural world. If we are to heed the constant call and challenge of the book: "What connexion can there be [...]?" (197) then the "connexion" or the *megalosaurus*' place in the order of things must be addressed. Morley, however, it should be noted, emphasises the reptilian and crocodilian nature of the *megalosaur*, as opposed to Dickens's elephantine creature. First, it merges mythical fabula and empirical matter, preserving a system of correspondences between the physical world and any metaphysical order behind it; but, in turn, questioning any continuity of correspondence. Another words, it does not resolve itself to transcendentalism. Second, it questions typologies, and genealogical structure as observed in both physical and metaphysical terms, while simultaneously strengthening those types and connections. The *megalosaurus* is the past palaeontologically reconstructed. Moreover, it provides an unwelcome anatomical connection between monsters and man, between reptiles and mammals. In the context of this study, the *megalosaurus* invites questions of transition between mammals and reptiles. Conversely, in Owen's hands, the pachydermal *dinosaur* resists Lamarckian progression and a Geoffroyan unity of plan. At the same

time, Dawson claims the act of palaeontological reconstruction produces a very different relationship between Victorian science and serialised fiction.

The *megalosaur* de-centres human centrality in creation (as framed by human narrative) and provides an alternative grand narrative that, as Lyell put it, is "insensible to our presence" (in Beer, *Darwin's Plots*, 22). However, when iterated in human narrative in *Bleak House*, it also re-centres humanity and reasserts natural theology. Genealogically speaking it implies monogenetic development from reptiles to mammals, whilst leaving open possibilities of complete polygenesis. Owen removed the *megalosaur* from the lesser reptiles to confound themes of reptilian progression. This separation and restoration of order ,Dawson describes as a feat of natural theology ("Literary Megatheriums", 208). Of course, it also emphasised the random boundaries that divide humans and other animals. As an act of natural theology, the *megalosaur* returns man to the center of creation; but at the cost of stronger genealogical ties. Just as Morley's Phantom Ship sets sail on its antediluvian cruise:

> So we walk down Cheapside, bustle aboard at London Bridge, and sail out, leaving man behind us. Leaving man behind us; for a thousand years roll back upon themselves with every syllable we utter; years, by millions and millions, will return about us, and restore their dead. (*Household Words* III, 494)

The *megalosaurus* is such a restoration of the dead in *Bleak House*. Dawson describes these reconstructions as "an organic model for the underlying unity of nineteenth-century fiction" ("Literary Megatheriums", 208). Buckland concludes that the *megalosaurus* is a "popularising image" aimed at the middle-class masses stepping out at Crystal Palace, the panorama, the Egyptian Hall and so on:

> For the 1850s reader this is not a wholly disorienting passage but a specifically orienting one: with its dioramic vision, the scene's present-tense language reads like a set of stage directions ushering in the image that overlays the Holborn district, holding modern London and a prehistoric swamp in a single view. (266)

While this is valid as historicist criticism appraising reader reception, I argue that it focuses critical attention away from the significance of the *megalosaurus* in the anatomical and palaeontological debates of the 1840s when the events in the novel take place.

Summary

This study refocuses critical attention on the interaction of science and Dickens's *Bleak House* to the 1840s. I argue that Cuvier's functional anatomy is of continued central significance to the anatomical debates between Lamarckians Grant and Geoffroy, and the conservative Owen. Dawson proposes paleontology as "an organic model for the underlying unity of nineteenth-century

fiction" ("Literary Megatheriums", 208). Owen's invention of the *dinosaur* as a mammalian land reptile produces context for Dickens's *megalosaur.* I incorporate both Secord and Buckland's geological criticism that geology does not produce narrative but instead subverts or collapses it. But anatomy and palaeontology instead become the principal scientific mode in Dickens's empirical truth enquiries enacted through the reconstructed textual narrative of Esther. Together, these historicist approaches reorder initial criticism that privileged Darwinian models. They produce a new and more nuanced account of the interactions of science and literature in nineteenth century British fiction. An account where Cuvier is of critical significance, within a heterogeneity of diverse actors, practices and narratives.

10 Bleak House

Richard Owen's re-engineering of the fossil record introduced the *dinosauria* to 1840s Britain. Owen's shift from giant reptiles to large land saurians separated the dinosaur from reptiles in taxonomies, a critical practice in countering the spectre of transmutation in Britain. In doing so, Owen cemented his own position as darling of the Anglican science elite, in a period that would witness the sensational release of Robert Chambers' evolutionary epic *Vestiges* (1844).[120] Desmond notes Owen's letters demonstrate his "primary target was transmutation, particularly in its application to man" (*Archetypes and Ancestors*, 33). More than ever boundary work was required to suppress progressionist Lamarckian tendencies. Britain of the 1840s was no less turbulent than the 1830s. The Chartist movement aimed to redress the imbalances in the Great Reform Act of 1832, and this led to riots in 1842. The repeal of the Corn Laws in 1846 after potato crop failures mollified radicals in Britain while Europe was convulsed by revolution in 1848. The Great Exhibition in 1851 marked the pinnacle of British science, navigating a middle path of reform and technological advancement while the spectre of revolution continued to haunt the continent. At the very centre of the discourse and contest to command the cultural space of science was the practice of suppressing Lamarckian revolutionary tendencies. By the 1840s Owen had played a hand in rival "English Cuvier" Grant's financial ruin. However, his championing of functional and teleological anatomy over continental philosophical approaches produced pseudo-mammalian dinosaurs, as the battle of form versus function meant taking any measures necessary to ensure the proper practice of British science under the threat of continental revolutionary theory.

"We seem to be in a world near the beginning of time, when the primal flood, a flood whose context is Victorian geology rather than the Bible, has but newly retired from the face of the earth" (60-1) writes J. Hillis Miller of the opening chapter of *Bleak House*. The geological setting has been highlighted by various critics,[121] and Dawson has emphasised the formal similarities between the popular serialised nineteenth-century novel and the processes of palaeontology.[122] Palaeontology in this period is in the custodial hands of Richard Owen. Desmond (*Archetypes and Ancestors*, *Owen's Reaction to Transmutation etc)* has outlined his efforts to thwart transmutational

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[120] See Amigoni & Elwick, *Victorian Science and Literature Vol. 4*, xi-xv, for a summary of the role of the evolutionary epic. See also Secord, *Sensation.*

[121] O'Connor, *The Earth on Show;* Buckland, *Novel Science;* Zimmerman, *Excavating Victorians.*

[122] Dawson, *Literary Megatheriums*, 208.

explanations of the fossil record through various means. *Bleak House* interrogates geology and theology in its natural world setting, its comprehensive snapshot of the human world, and its narratives of individual human struggle. Its various mysteries suggest a paleontological process of disinterment and decipherment after Dawson.[123] A reformist agenda in a spirit of compromise in order to suppress revolutionary tendencies in progressionist movements dominates the cultural work of 1840s British science. In this sense, work on *Bleak House* engaging with evolutionary models is not misplaced. However, its politico-scientific context, I argue, is that of 1840s transmutation and Lamarckian progressionism. *Vestiges* plays a significant role in this as providing a progressionist and novelistic narrative for Lamarckian morphology. *Bleak House* engages with this context of understanding nature in 1840s Britain, and, in particular, its extrapolation to the human world. Although Lyellian actualism continued to dominate British geology, with its theoretical separation of man and natural world, the expedient division of the two does not hold in Dickens. Their interconnection is interrogated in *Bleak House* at an overarching level through the structure of its narratives and narrators. This geological meta-context frames the novel's rich internal world. Much has been written of the book's opening chapter, *In Chancery*, and the image of the *megalosaur* at its head.[124] Considering the overarching science narrative of the 1840s, this palaeontological appearance does not seem strange.[125] It is at the very centre of the contest for British science, and, I argue, plays a functional role in maintaining stability and continuity in British political and ideological life. The stable actualist geology of Lyell, its neat separation of human from natural world, resists Lamarckian progression. *Bleak House* inhabits the same cultural space as this struggle. At the same time, the Anglican establishment and genteel elites endeavour to reassert natural theology. Materialism had to be countered, just like political unrest, through the path of ideological reform. Whatever ground had been ceded in the establishment of a progressive geological record in the 1840s still needed to be reframed within the context of divine providence and Christian authority. This politics of nature will be read out into *Bleak House*. But all these contexts are subordinate to the contest for internal morphology, or anatomy of living organisms and palaeontology in terms of fossil remains of extinct ones. *Bleak House's* broad societal embrace engages the contest between form and function, between philosophical and functional anatomy.

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[123] Dawson, "Literary Megatheriums and Loose Baggy Monsters: Paleontology and the Victorian Novel", "Paleontology in Parts: Richard Owen, William John Broderip, and the Serialization of Science in Early Victorian Britain."

[124] Turner, *Mechanism and the Novel;* Miller, *Charles Dickens: The World of His Novels;* Zimmerman, *Excavating Victorians;* Buckland, *Novel Science.*

[125] Buckland, Novel Science.

Even at the level of the individual, the search for meaning engages this internal anatomical drama. Owen's emergent transcendental anatomy used German *naturphilosophie* to postulate archetypes in nature, transcendental ur-types present in Lyell's separate natural world. Indeed, the Lyellian separation of human reason and natural world does not hold in *Bleak House*. Instead, I suggest, a transcendental and idealist anatomy of ur-types and archetypes produces Gothic intrusions into empirical reality.

Bleak House's main story follows the fortunes of protagonist Esther Summerson, whose chapters constitute a first-person narrative running through the novel. Esther is taken from her childhood home to Bleak House, to live with her guardian Mr Jarndyce, and the two wards of court and beneficiaries in the case of Jarndyce and Jarndyce, Ada and Richard, who form an amorous connection. Richard decides for a career in law, and gets sucked into Jarndyce and Jarndyce his health deteriorating steadily. Before Esther's narrative begins, however, in the novel's first chapter, *In Chancery,* an omniscient third-person narrator transports us to the Lord High Chancellor in the High Court of Chancery where the interminable case of Jarndyce and Jarndyce drags on, then to Chesney Wold, the home of Lady and Sir Leicester Dedlock, where their lawyer, Mr Tulkinghorn is visiting. These two narratives run throughout the novel, both mysteries, all intertwined. In the first narrative of the omniscient narrator we meet a series of mysteries. Tulkinghorn's suspicion of Lady Dedlock leads him to the dead body of law-writer Nemo, above Mr Krook's rag-and-bottle shop. Tulkinghorn enlists inspector Bucket, whom street urchin Jo tells of a veiled lady, leading Bucket back to Lady Dedlock's maid Mademoiselle Hortense. Bucket then investigates the death of Tulkinghorn in a genre-forming murder-mystery, eventually arresting the maid. In the end, Richard dies and Ada has their baby, Jarndyce buys a new Bleak House but Esther marries doctor Woodcourt. The mystery of Esther's identity as Lady Dedlock's daughter is solved.

This study focuses on common and divided cultural contexts of literature and science. Narration has been critical in identifying cultural bridges between scientific and literary production. *Bleak House* completes the study in producing a complex narratorial structure; one which may point to a significant shift from naive empiricism and toward a narrative that explores transcendence as a biological theory. The timelines of the novel are divided into the past-tense chronological reconstruction of Esther, and the present-tense detached time that exists at the beginning of the book. Esther's chapters are written seven years after the narrative of the omniscient author interspersed throughout the serialised book. Miller argues that things "exist not "one by one," but simultaneously" drawing on the use of infinite particles in never-closing clauses. He argues that they form "a continuous non-progressive present time" (165). Miller seems to imply the Lyellian

actualist model of non-progression, upon which human reason projects progression as human history. So the second account runs directionally from past to present against this "non-progressive" time, looking to explain "how the world came to be in the befogged, mud-soaked, fragmented and decomposed state presented in the initial paragraphs" (168). When Miller contends that "all the novel is present in the initial moments" (168) this contradicts the causality demonstrably at work in the mysteries, and their logical investigation and solving by, respectively, legal clerk Guppy and inspector Bucket. *Bleak House* was serialised in *Household Words* in 1852-1853. If Esther's narrative is seven years later than the non-progressive frame, the original historical context of the novel moves a lot further away from *Origins* than many critics would like to admit. *Bleak House* shifts away from authorial contemporaneity, and back to where the author's imagination propelled it. The frame is in the first half of the 1840s, Esther's narrative in written form before the serialisation in the early 1850s. Darwinian modes of thinking are far from being culturally embedded, and the *megalosaur*, which has traditionally drawn the critical eye to Crystal Palace and the early 1850s, is redrawn to the early 1840s and its centrality to Owen's 1842 taxonomic reshuffle. As a result, the temporal sophistication is only increased: the present we assume we are in is no longer a present. But the ahistorical nature of the geological mode means it does not matter as all moments in time are of equal significance until human reason is applied. The reader's arrival specifies the start of the novel's directional temporality. In fact, without Esther's narrative, *Bleak House* remains atemporal. It is therefore not surprising the novel has been read as if the ahistorical and non-progressive time of the frame of *In Chancery* is somehow consistent with the author in 1852-1853. If the generally accepted critical reading of the frame is correct, then it is inconsistent with any specific time. But the existence of Esther's narrative in our geological record confirms the novel's setting as being set in motion in the first half of the 1840s. While accepting the inability of authors to write themselves completely out of their own literary productions, not all meaning has to be subjugated to the temporal and spatial context of the act of writing. While Secord has demonstrated meaning can be traced to publication and product, to readership, and to new temporal and spatial sites, so too can contextual meaning be historically realigned to reflect the novel's anatomy, both functional and philosophical. This is not to dismiss other sites of meaning, but to add to them in the continuing process of contextualisation and criticism.

Pachydermal Dinosaurs & Lamarckian Lizards

The *megalosaurus* of *Bleak House* conforms to Owen's recasting of the "giant lizard" in 1842 as anti-Lamarckian polemic. At "forty feet long or so" the *megalosaur* matches Owen's new length

estimates, based on measuring individual vertebrae, compared to Buckland's original calculations of sixty or seventy feet. In the process, Owen lengthened the creature's legs to mammalian proportions in order to support the shortened trunk. This produced a distinct shift from an ostensibly scaled-up lizard of giant proportions to a new pachydermal dinosaur: stout, compact, rhinocerine. This is the beast that is pictured "waddling" up Holborn Hill like a massive "elephantine lizard". Owen's dinosaurs truncated a Lamarckian scale of progression from simple to complex organisms. Small reptiles had not simply become larger and more complex reptiles; instead, the pachydermal dinosaurs were in their own ordinal class, and modern lizards could even be explained as a degeneration of the great lizards of the past, reversing the progressive order. The *megalosaur* of the early 1840s juxtaposes transmutation with degeneration. Smoke sinks from chimneys turning into black drizzle and the soot flakes pour down on the earth—carbon, coal, the strata, the fossil bones. In mourning, the narrator imagines, for "the death of the sun", conjuring up Byron's *Darkness*, but the poetry is simple everyday dirt. The external world is cloaked and illegible; its origins and its present beyond vision or comprehension. The geological panorama provides no clear narrative and conforms to Secord's "anti-narrative" and Buckland's "geological breakdown". Having superimposed the distinctly mammalian *megalosaur* on London, symbol of degeneration, for retrogression, the narrator re-ascends from dogs through horses to mankind, all embroiled in primaeval mud, all scrabbling and sliding about but slipping in "since day broke (if this day ever broke)" (*Bleak House*, 5). If contradicting transmutation and progression means degeneration then any victory is pyrrhic. "We seem to be in a world near the beginning of time, when the primal flood, a flood whose context is Victorian geology rather than the Bible, has but newly retired from the face of the earth" (160-1) writes J. Hillis Miller. But creation and the post-diluvian world, filled with rhinocerine monstrosities, seems nothing more than a muddy hole. Beasts and men are collapsed in their chain of being into the primordial mud-soup of the streets. Time is subverted (or perhaps simply reset) as this day becomes at once all time and no time at all. The animal and human kingdoms are "adding new deposits to the crust upon crust of mud" (5). This palaeontological play ends in a joke on "compound interest" implying that we are all but another "crust" to be added to the earth. *Bleak House's* geological foundation interrogates palaeontological debate of the 1840s. Its first paragraph presents us with Owen's new dinosaur of 1842, specially equipped to repel

Lamarckian progression and transmutation, both a professional and ideological threat.[126]

Chesney Wold is linked to biblical and geological past-time with its "antediluvian forest" (*Bleak House*, 347); Sir Leicester Dedlock burns wood from before the biblical flood. The antediluvian forests of Chesney Wold suggest a link and historical continuity in Sir Dedlock's lineage and in the land itself. It both reaffirms and calls into question the Mosaic account, and thereby the social order and hierarchy. The narrator has "the fashionable intelligence" proclaim "to the listening earth" (347) of Lady Dedlock's return, alluding to Joseph Addison's *The Spacious Firmament on High* whose last line, "The hand that made us is divine", recapitulates the hymn's singular message of natural theology: that evidence of God may be found in nature.[127] However, this is a new and brutal natural theology that includes powerful quadrupedal pachydermal dinosaurs conjured up by English Cuvier, Owen. Chesney Wold provides a duplicitous and dichotomous image of time as felt in *Bleak House*. On the one hand, it is living (if dying and decaying) proof of an existing order, an order that, as imagined in the natural theology of works such as Addison's, proves and demonstrates order, intelligence and divine presence in nature. On the other hand, Chesney Wold is part of the decomposing, decaying, dying universe imagined in *Bleak House;* a rotten-borough landscape under siege from reformists and radicals. It may point to a persisting Huttonian conception of time as perpetuated in Lyell's *Principles*, a slow eternity of decline: "around and around the house the leaves fall thick—but never fast, for they come circling down with a dead lightness that is sombre and slow" (356); a time without beginning or end, hence bereft of ultimate cause and purpose. "Let the gardener sweep and sweep the turf as he will, and press the leaves into full barrows, and wheel them off, still they lie ankle-deep." (356) Note the slow procession of present-tense verbs, the insertions in commas fronted with 'and', all inexorable, irreducible, unending. At the end, if end it be, the leaves still lie ankle-deep. This is the kind of leafy weald where the fossil bones that constitute Owen's new dinosaurs were unearthed. However, the degeneration required to invert Lamarckian transmutation seems to have rendered the earth infertile and in decay. Lyell separated the natural world and human reason in his counter of Lamarckian progressionism. In turn, without sufficient human reason nature may then simply arrest in stasis,

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[126] Richard Owen wrote three articles for Household Words. The second, 'Justice for the Hyaena' (*Household Words* VI. 373-377) appeared on 1 January 1853. Owen refers in passing to Buckland's discovery of the 'Hyaenas' Den' at Kirkdale: "The gloomy abodes of the hyæna are caves and the recesses of rocky hill-sides, or the vaults of old sepulchres, deserted dwellings, and ancient ruins." (*Household Words* VI. 376) The familiarity with Buckland and the Kirkdale find demonstrates Dickens more-than-passing acquaintance with the area of geology. Owen goes on to cite Cuvier as an authority alongside Aristotle; Cuvier making "excuses" for the "father of science" for "strange and apocryphal bits" in his description of the hyaena (*Household Words* VI. 376).

[127] The hymn features in Haydn's *Creation*, and is sung in *The Mill on the Floss.*

rather like the ever-deep leaves lying on the Wold. Human reason in *Bleak House* seeks "connexion" (197) but ultimately fails, left wandering in the geological wild of un-meaning: "we were all bewildered" (762) John Jarndyce intones. Without recourse to external empirical meaning, the reader makes connections more freely. The metaphorical leaps could point to similarities with Owen's new transcendental biology? Do the characters speak as archetypes? Are there formal similarities between modern-day magic realism and Dickens?

One of the very last numbers or chapters, *Beginning the World,* invites a cyclical conception of time, where the world is undone and redone, begun anew. "I will begin the world!" (*Bleak House*, 763) exclaims Richard on his deathbed. This episode is recounted, of course, by Esther in her chronological reconstruction. She adds: "Not this world, O not this! The world that sets this right." (763) Her natural-theological standpoint colours the episode, she invites a double existence of ephemeral and eternal worlds that make uniform sense of Richard and Ada's catastrophe. Turner (84) compares Esther's perspective to one of natural theology where the universe is both "mechanical and meaningful". However, having entered the complex and conflicting universe *Bleak House* presents we know that this interpretation, or belief, is always incomplete. Moreover, Richard does, literally, begin the world again in the shape of his son in the new Bleak House. This "beginning" haunts Richard throughout the book, as John Jarndyce charges both Richard and Ada: "[...] begin afresh! Bygones shall be bygones, and a new page turned for you to write your lives in." (303). Jarndyce equates their lives and individual experience to written narrative and textual artefact. He implores Richard: "Better to borrow, better to beg, better to die!" (302) Better anything than to rely on the court case and the "great system" (740). The advice of the sage Jarndyce is to abandon any unified theory of everything, a grand narrative, and to embrace a thoroughgoing individualism, which is where the hope in the bleak house of *Bleak House* lies. John Jarndyce says to Richard, "How I hoped you would begin," (302) and there is Richard's stopping point, in beginning the world. Watt's "primacy of individual experience"[128] is really the only tenable model for "salvation" or secular redemption in *Bleak House*. In this sense, it demonstrates how the novel in itself becomes a new structure for how to live and understand your life. Richard becomes a tragic figure because he does not embrace the mode of the novel as genre. He never successfully reproduces the expression of the novel in privileging the actions of individuals in particular circumstances. Instead he clings on to the hope of Jarndyce & Jarndyce, and Chancery become analogous with traditional non-progressive plots that promote conformity and accepted wisdom.

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[128] Watt, *Rise of the Novel*, 14.

Richard never accepts his particular circumstances and always acts out of wider and more general causes. His downfall is in not adapting to the novel's mode of modernity; his failure within the story is, in the same way, a reflection on his method, rather than his station.

'Beginning the World' as a closing chapter makes the reader aware of the narrative process, and also of the broadest ontological category of theories of the earth. Richard needed individual progression, which he applied through Lyellian human reason rather than empirical practice. Richard denotes a broken and outdated mode of narrative configuring a plot that simply does not work any more. He should have become the individual in particular circumstances that could triumph over his those specific circumstances. The novel through its instability of form, its originality and adaptability successfully navigates modernity. It is a method of success just as traditional plots were in literature in their time due to their stability and recycling of known stories.

Beginnings and ends frame the book, the characters, the chapters or numbers. John Jarndyce renounced his claim in Jarndyce & Jarndyce and "began the world" in *Bleak House*, a bleak house reborn, if still prone to "a wind in the east". These textual invitations to begin the world are born of the resolution found in Esther's narrative. Characters and readers are challenged to begin the world, just as Esther's narrative began the novel in a certain time and place. Moreover, they point to possible hope devoid of any "great system" (740), and inherent in the individual. Esther imposes a system of "naive empiricism,"[129] bereft of artfulness and skepticism, performed through the modes of both science and print revolutions. Esther's text imposes empiricism and stability on an unstable system of narrative. Bleak House, the first of its name to appear in the novel, is an example of how Dickens' universe is replete with meaning, but meaning that constantly collapses. Indeed, the book becomes a physical monument in the natural world; textual artefact becomes object. Named after John Jarndyce's father who shot himself there, it signified a new beginning, a moment of destruction and creation, and a renouncement of all claims in the Jarndyce & Jarndyce case. The name echoes the past line that converged on catastrophe. And yet Bleak House, with its Growlery, is a place that becomes filled with love, respect and friendship; its wind not often in the East. There is warmth, humanity, and true companionship among the house that houses the wards of Jarndyce, the juridically undone. Bleak House, is instead of being torn down, rebuilt — as a symbol of hope —re-territorialised, repositioned and renamed. Woodcourt and Esther move into a new Bleak House at the behest of Jarndyce. The multiple creations of Cuvier's earth history are sensed in this story line, framed in a final chapter entitled 'Beginning the World'. But that new Bleak House is essentially

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[129] McKeon, *Theory of the Novel*, 384.

the textual artefact of the book, reset and restarted. In other words, the only new beginning is a new narrative, and with it a new attempt to understand truth and produce meaning. Korg (*London in Dickens' Day,* 13) describes the superficially romantic resolution to plot as a refuge from society; "an oddly irrelevant escape from the forces at work in the action of the story, not a victory over them". Bleak House is a physical monument, an "antiquity of nature", that only makes sense once populated with hopeful human narrative. At the same, *Bleak House* is the textual artefact, the story within that textual artefact, and, presumably, a description of the fabula from which the story is ordered. It seems capable of movement that traverses any progressionist boundaries. In fact, much as the image of the *megalosaur*, Bleak House transitions through boundaries. Whether its morphology as a symbol can be likened to Geoffroyan transitional states as they move through a unity of plan, or whether these symbols produce archetypes that transcend boundaries in ideal forms, *Bleak House*, the story contained within the text, aligns itself between Geoffroyan morphology and Owenite transcendent biology. How it incorporates these different science stories differs between the narratives.

"What connexion can there be [...]?" (197) is the ever-present question of *Bleak House*. Reading an illegible world, constructed of unreliable human texts and narratives proves impossible for most characters. The textual past-tense of Esther's Narrative and the omniscient narrator's third-person present provide different ways of reading the world, and different epistemological approaches to the universe. But that world, as J. Hillis Miller (*Charles Dickens*) points out, is little changed from beginning to end; moreover, it is an end entitled 'Beginning the World'. The internal disintegration and Buckland's "urban chaos" (*Novel Science*) lead us away from Chancery to a physical and spatial world. The various physical monuments of the house itself, the giant fossil monster, the antediluvian world of Chesney Wold, the textual and logocentric stasis of Chancery all link the present to a very ancient past like Owenite archetypes. The connection is never completed, the glimpse never lasting; but somehow there is a connection from present to ancient past, both spatial and temporal. Is the connection geological through Lyellian ahistoricity, or is it perhaps Owenite in the archetypes of transcendental biology? There is a sense that we are invited to revive and reconstruct the "scattered and mutilated fragments" of past worlds in order to understand our own; to become a "new species of antiquarian" in understanding the limits of human understanding, the unreliability of human and textual narrative, and the massive extent of earth history. Only Esther's narrative can initiate a directional timeline allowing us to reorder the world empirically and chronologically. Esther applies a form of "naive empiricism" in recreating the world through an empirical perspective, aligned with science but rendered through print and textual artefact. Her

science is most closely aligned to Cuvier's law of correlations. She extrapolates only as far as she can, piecing back together her own life through the parts of the whole she is given, literally piece by piece. The omniscient narrator, in sharp contrast, brings skepticism and irony, destabilising the narrative into confusion and bewilderment. In this narrative geological perspectives fail to produce coherent story, instead lapsing into breakdown and anti-narrative. Moreover, the individual and her experience in her particular circumstances is privileged as method. This need for originality of form allows primacy for an individual to overcome particular circumstances. All the while, the natural world in Dickens is in decline. This triumph of degeneration over transmutation and progression suggests an Owenite victory over the anatomy of Grant, Geoffroy and Lamarck.

Transcendental Biology

At the centre of *Bleak House* is a complex understanding of nature that has been variously claimed to align with evolutionary biology, geology and archaeology, uniformitarianism and catastrophism among many other readings.[130] The novel does not produce a simplistic or unified description of the natural world, there is no "great system" (740). Lyellian geology in *Bleak House* requires human reason to provide progression to a world otherwise in stasis or in a state of degeneration and decline. The British Association for the Advancement of Science fronted by Owen worked to perpetuate scriptural theology. In the process, Owen produces a pachydermal dinosaur to enforce reform over Lamarckian revolution. The battle of form against function begins with the function camp prepared to "play dirty". Forms that are transitional and imply movement within organisms and characteristics oppose the varying forms of functional fixity offered in the practice of traditional 1840's science. *Bleak House* cannot resolve form and function in understanding any "connexion" (197); instead, early 1840s science debates permeate the worlds of the narrators. These various worlds in *Bleak House* are in decay, they are broken and highly dysfunctional. The written word of Chancery at its core is unable to effect dynamic change; the great system is in paralysis. It seems that human reason has failed to provide progression, and it too has fallen into stasis, until Esther arrives to realign it, but only for a moment in a particular time and space. The natural world also denies simple progressionist, historical interpretations. The search for meaning in the novel produces an unintelligible universe not easily read. It produces a world of "connexion" (197) that might imply a unified system in nature, but human narrative is ill equipped to interpret that world and its phenomena. Failing external understanding, the theme of connexion is internalised. External morphology cannot sustain meaning, as a serious of mysteries permeate the plot. Instead, internal

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[130] See Levine, *Darwin and the Novelists,* 119; Zimmerman, *Excavating Victorians,* 143-4; Levine, *Darwin and the Novelists,* 119; as examples of types of readings stated.

morphology alone can provide knowledge of nature. The anatomical and palaeontological debate might explain *Bleak House*.

A critical number or chapter in the book is undoubtedly *Tom-All-Alone's*. It is a pivotal in that the theme of connexion erupts in a confrontation of worlds and the ends of society's traditional chain of being. Initially, the pendulous and capricious movements of Lady Dedlock are contrasted with Sir Leicester's hereditary gout. Her restlessness implies her unwillingness to accept the order and state of affairs: it is a dilemma of progression. In contrast, Sir Leicester submits himself to his illustrious family infirmity. As Sir Leicester is drawn back through time into death and ancestry, Lady Dedlock flits like a shadowy wight from country to town, and town to country. The narrator implies and explores connections. There is movement and disorder in the social order; unseemly connections and ties between top and bottom. This kind of movement between types reproduces Lamarckian transformism, where intention on the part of the individual can lead to change; emphasising the kind of social mobility power elites wanted to suppress, or if absolutely necessary offer reform in order to appease. The other motivating factor in Lamarckian progression is the environment. Geoffroy employed this to counter Cuvier in debate in the 1820s and 1830s. Monstrosities were examples of sudden and violent change as a result of environmental factors. *Bleak House* juxtaposes extremities of the accepted social order, but both environments are repellent. Chesney Wold may exhibit fewer sudden and violent changes, but both metropolis and the bucolic weald are driving factors in producing change. The stench of gout and of death pervades the rotten borough of the country seat and the shambolic underbelly of the shanty-city. Street urchin Jo is near the bottom of a traditional scale of beings in the human social order. Yet, though he has no seeming chance of progression or recourse to human reason to impose progression on a non-progressive natural world, Jo performs a function, and in that function sweeping his crossing has purposiveness. His mantra of "don't know nothink" chimes out through the mud and the mire. In cleaning the crossing and trying to pull himself out of poverty, Jo does not enjoy any progression: "He knows it's hard to keep mud off the crossing in dirty weather, and harder still to live by doing it. Nobody taught him, even that much, he found it out" (197). Jo is caught in functional fixity, in the Sisyphean task of street sweeper in a city made of mud, crust upon crust. Jo is tied to that same muddy hole from whence the taxonomic monstrosity of the *megalosaur* emerged in the opening frame. It reversed any progressive flow from lower to higher forms, condemning Jo to degeneration back down the scale of beings. Jo may have functional purpose, just as Owen's monstrous *megalosaur*, but that function stops him freeing himself from the mud and the mire. Instead, Jo will degenerate down the scale of beings, and slip into the mud and the mire, compounded into London's

bestial abyss.

The omniscient narrator confirms the case: “Jo lives—that is to say, Jo has not yet died—in a ruinous place”. *Bleak House’s* language is unforgiving: “maggot numbers”, “vermin parasites”, these are not creatures experiencing the grace of god. These are degenerated human beings: “the ruined human wretch”. But not degenerated to some Romantic Rousseauvian savage state; instead, to “a swarm of misery”. There is little doubt that design, in terms of natural theology, could only be seen as malignant, as “sowing more evil in its every footprint”. The degradation of Jo until “scarcely human” is an everyday occurrence; he is one of the “lower animals capable of only “animal satisfaction” as the narrator compares him to a dog: “Turn that dog’s descendants wild, like Jo, and in a very few years they will so degenerate that they will lose even their bark—but not their bite.” (198) *Bleak House* shares the overt scientific aims of countering Lamarckian progressionist models and replacing them with remarkably bleak models of degeneration. But turning those models around produced cruel, anti-Christian schemes of degeneration, a brutal and repressive practice of natural theology. Buffonian degeneration, as worked on by Cuvier and Geoffroy in the 1790s, was a form of speciation reversing any progression and upward movement from lower to higher forms. Jo epitomises the results of ruthless anti-Lamarckian science as sponsored by governing elites. But the human revolution that creationist politics try to avert produce environmental disaster leading to similar outcomes. Tom-All-Alone’s, a forsaken area of “tumbling tenements” (197) in Chancery, is snap-and-heel next to the law courts and the jaundice, and *jaunice* (Fr. Jealousy), of Jarndyce and Jarndyce. Here the landslides, “a crash and a cloud of dust”, the houses falling, sporadically punctuate the everyday life amongst the lower order. Here at the breaking points, at the tipping points, the weak are caught in the quotidian catastrophe caused by the micro-variations and changes in their fragile, house-of-cards universe. The tremors sent through the entire aching and groaning “great system” cause daily disaster in these forsaken flash-points. The Lyellian uniform universe, with Cuvier catastrophe’s subsumed under observable evidence in the present, encompasses the world-description of Tom-All-Alone’s. The tragic consequences of a world mirroring Lyell’s separation of natural world and human reason, with human reason providing progression and dynamism, is that without that reason, the world alone is a terrible place. Jo's ignorance, his illiteracy, de-humanises him in a world ruled by human words and human law. His place is not assured in permanence as in the old paradigm, the great chain. Instead, Jo’s lot is cast with the cattle and life’s livestock—“I belong to them” (198)—as unwanted property. This, in itself, is a stone-shot against the old order, where human and non-human were separate in the fixity of species. There should be no movement from human to non-human in its perfect plenitude. Nor is

this animalisation of Jo through Lamarckian morphology. Jo's lot is not progressive; this is degeneration and regression. The very idea of human intervention for the betterment of a fellow being is lampooned and reserved for the "spiritual destitution of a coral reef in the Pacific" (199).

Jo is a "lower animal", a soulless beast, without hope of redemption. "Jo and his order" (199) are compared to the oxen on market-day who "often sorely hurt the innocent, and often sorely hurt themselves". And so the chain is thoroughly inverted, upset, upended, and collapsed. Jo is wild, "bewildered", without knowledge and place or station in life. In the end, Jo's dehumanisation is complete: "he lies up against the hoarding so like a growth of fungus" (556). The descent of Jo to the lowest of orders is an inversion of Owen's rising of the dinosaur up toward its peak. Functional purpose could not save him, without any progressive movement up the chain and away from his tragic end, he is reduced to the state of figurative fungus. Jo represents Owen and degeneration's victory over Grant and transmutation. Moreover, he represents a failure of Lamarckian transformism, as he is not able to transform himself or experience any form of progression. At the same, he cannot transcend his state and station in life unless his position is one of fixity in generation, squalor and poverty. If he is kept in his place by Owen's brutal conservatism reimposing natural theology then Jo is caught in a plot of natural theological extinction. Moreover, he also represents a failure of narrative in producing any meaning in life and the natural world, within the context of conservative political and ideological domination.

What space does the bleak house of Britain leave for the individual? There is a degree of typological familiarity to many of *Bleak House*, the novel's, characters. Are the dignified Dedlocks and street urchin Jo ideal types in a return to the taxonomies of romance fiction? Owen's move toward transcendental anatomy takes place later than the early 1840s. However, in Dickens, the struggle between individual and universal type, as outlined by Watt in the development of the novel contra traditional literary genres, is part of its anatomical concern. The metaphorical leaps of brutal and conservative forces of natural theology powered by idealist and transcendental palaeontology are reproduced as repressive societal circumstances and experience in *Bleak House*. In contrast, Esther's narrative embodies the application of human reason to nature providing progression and directionalism. Her narrative empowers her away from simple typologies and even the threat of degeneration. Esther's journey, though a form of return, does provide hope in the form of progression. Turner explains Esther's struggle: "The world of Bleak House is one in which pursuing truth is a psychological necessity; yet the available means of pursuit […] are imaginatively inadequate" (98). The complex temporal narratorial structure means any single human individual narrative could be superimposed in this pursuit of truth. The reconstruction of Esther's life is based

on a reintegration of human and natural world. It is an empirical narrative based on textual evidence from her account. Esther unites functional and philosophical anatomy for externalisation through the narrative reconstruction of her tale. On the one hand, her functional purpose is evident as the industrious Miss Summerson applies herself to her circumstances with great modesty and forbearance. She stoically accepts her circumstance. On the other hand, free of a fixity of type, not knowing her provenance she is allowed transition and transformation. Even her disfigurement as a result of illness shows an ability to overcome external morphology, and to reunite internal form and function. Geoffroy's "monstrosities" resulting from external environmental factors had prefigured the Cuvier-Geoffroy debate juxtaposing a dynamic anatomy where characteristics are passed on, change realised in a lifetime and transitional forms existing as a pathway between fixed ones.

Summary

Intersection between Dickens and Cuvier in *Bleak House*, I have argued, reproduces different science stories in a different context to our previous novels. These science stories voice a diversity of science practitioners and practice, but all of them incorporate or resist Cuvierian anatomy and palaeontology. While geology may provide a frame for *Bleak House*, the novel's primary function to produce knowledge and understanding, in its pursuit of truth, reproduces science stories of anatomy and palaeontology. Dawson has argued this constitutes an organic model for serialised fiction. His research provides the basis for a reassessment of *Bleak House's* context in terms of Owenite transcendental anatomy and anti-Lamarckian manoeuvring. The *megalosaur* synecdochally represents the *dinosauria* that thwart Lamarckian progression as disseminated by the influential Grant. I suggest this political and ideological work, on Owen's part, represents a brutal and repressive reassertion of natural theology and the political status quo it privileges. *Bleak House* contains a struggle between form and function in biological terms that undoes hope of Lamarckian progression, but never resolves itself into a full reassertion of natural theology or an enactment of transcendentalism. However, Owen's redirection of empirical science to incorporate Platonic idealism is reproduced in the rich symbolism of types in the narrative, and, moreover, that struggle of characters for individual status and therefore survival and success in the narrative system of the novel. Esther is the main example of success in her narrative which initiates chronology and produces individuality and a "primacy of individual experience" over a submission to genealogy and universal typologies. Her narrative empirically and textually reconstructs her individuality through a serialised story analogous with models of palaeontological process. In this sense, the narrative system of *Bleak House* extends and amplifies the empirical and novelistic methods of our

previous texts. However, it incorporates new science stories of competing anatomical theory that, I suggest, foreshadow the Darwinian evolutionary narrative. Darwin, therefore, makes way for a privileging of 1840s anatomical and palaeontological debate in *Bleak House*. A debate in which Cuvier remains central to practices and production of knowledge.

11 Conclusion

The first question this study asked was what was Cuvier's role and significance in Britain and British science in the first half of the nineteenth century. This study produces a different Cuvier in

different times and different places. This in turn changes the historiographical grand narrative of science. I argue that this produces a nuanced evidence base that re-interrogates critical use of Darwin. Moreover, it encourages a division of historical periods and a clearer examination of the science practice and knowledge production in them. The first period examined was from the initial publication of *Essay* in Britain in 1813 through to the early 1820s. This period was identified as roughly equivalent to the setting of the story frame in the novel *The Last Man* in 1818. The publication of the textual artefact first occurred in 1826 and the period of writing equates roughly to 1824-1826. The initial historicist approach aimed to put Cuvier in context. The competing science stories of this early period of the gentlemanly Anglican elite which traditionally frames the account of geology in Britain were, first, the British Huttonian eternalist theory of the earth as popularised by Playfair in Edinburgh. Playfair was, in turn, entangled in an ideological debate over neptunist and vulcanist mineralogies with Jameson, who published Cuvier's *Essay*. Cuvier was duly used by Jameson to support his own neptunist geology. In the process, Cuvier was aligned with British natural theology and what was only later to be termed catastrophism. In England, Buckland incorporated Cuvier into his diluvial geology in Oxford. However, Byron drew attention to the expediency of Anglican power elites in *Cain*, and Cuvier was simultaneously incorporated into radical Lamarckian political elements in Britain. As a result, even the Cuvier we encounter in this first construct of a period is a different Cuvier to different people in different times and different places. His scientific legitimacy and the popularity of his *Discourse* aimed at the general reader produced powerful scientific knowledge to describe both the natural and human world.

The second period I identified equated, perhaps more precisely, to the setting of Eliot's *Mill* from the late 1820s through to the late 1830s. To some degree, this division conveniently followed chronology from Shelley's *The Last Man* through to *The Mill on the Floss*. This second period represents a distinct shift in British science. First, the Anglican conservative elite sought to counter radical Lamarckian elements through the BAAS inaugurated in 1831 and the Bridgewater Treatises, explaining science within a narrative of natural theology. Buckland headed the diluvial camp in geology in contrast to Lyell's new actualist geology that separated the natural world from human reason where progression was possible. Secord describes Lyell's geology as "anti-narrative" (*Introduction*, xviii), but Lyell's *Principles* successfully incorporated Cuvierian mechanisms of change within a non-directional natural world that countered Lamarckian progression. Moreover, Lyell's geology resisted scriptural narrative and legitimacy. Again, we encounter different Cuviers through different practices and different historical actors. Buckland, Lyell both claimed and incorporated Cuvierian anatomy and mechanisms of catastrophic change

revealed through the law of correlations into their own practice and for their own advancement. Similarly, Geoffroy and Grant resisted Cuvierite authority as a source of legitimacy as a politically and ideologically dominant science narrative. Their science stories compete and interact to produce new models for nature through the period.

Third, the historicist project moves into the 1840s to map the science stories and interactions with Cuvier in context with the setting of Dickens's *Bleak House.* Although the period continues to reproduce the same conservative and radical agendas and narratives in science as the 1830s, i.e. those of natural theology contra Lamarckian progression, the period does develop its own particular science practices and stories that represent a dramatic shift in nature and in the novel. I argue that initial significance placed on the grand narratives of geology shifts onto the anatomical and palaeontological science debates as new anatomical positions, both conservative and radical, vie for political and ideological domination. Grant practices Lamarckian biology and Geoffroyan philosophical anatomy in London, while Owen counters with his own reformist and repressive reactionary agenda. Transcendental anatomy is Owen's response to the transitional morphology of Geoffroy. Dawson has argued that palaeontology and anatomy provide an effectual organic model for serialised Victorian fiction.[131] This period charts the rise of anatomy over geology as a dominant scientific narrative within British fiction. This scientific discourse perpetuates Cuvier's centrality to British science through the 1840s and on into the 1850s.

In sum, the historicist approach to the overlapping historical periods of "Cuvier in Context" have demonstrated how Cuvier's science and practice are reproduced throughout the entire period. Cuvier is always part of a community of science practice in particular times and places. This diversity of practitioners and historical actors gives a nuanced understanding of Cuvier's science in context, and, moreover, of the rich heterogeneity of nineteenth century British science. Cuvier becomes a significant player in pre-Darwinian evolutionary science without ever becoming an overarching model. Indeed, our recognition of the diversity of actors and the diversity of their positions according to context reaffirm this fact. Dawson may have proposed Cuvierian palaeontology as a potential organic model for serialised Victorian fiction. But this claim of formal similarities must be subjected to similar nuanced contextuality that produces different models in different times and different places.

The second and third questions asked in the introduction were methodological. The first goal was to combine both formal and historicist approaches to literature and science studies where

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[131] Dawson, "Literary Megatheriums", 208.

appropriate. In particular, one explicit aim was to incorporate the progress made in history and sociology of science, while retaining literary analysis and sensitivity to use of language. The historicist emphasis on evidential accuracy and attention to, for example, so-called actor-categories questions previous assumptions that produced dominant models for and narratives of science. The need to produce a Cuvier specific to particular contexts and intersecting with a rich variety of actors and even inhabiting potentially contradictory positions due to those historical approaches. As a result, the significance and centrality of Cuvier to those particular contexts and communities of science have been reproduced. The third question asked by this study was how a successful synthesis of these two differing approaches assigning textual meaning to two very different sites could be combined as Dawson and Beer have suggested. I proposed a narrative based approach could add a third potential formal site of meaning in the story element of the novel, the fabula and text being loosely but not exclusively associated with authorial intention and reader reception respectively. This led to a refocusing of the scientific and cultural contexts of Eliot, Dickens, and, to some extent, Shelley. This additional site of meaning does not invalidate other approaches and research. However, particularly in the case of Dickens, and also in the case of Eliot, it has allowed a considerable shift in the focus in terms of history of science. Dickens's *Bleak House* has successfully been read back to the original, and often misunderstood, internal chronology of the novel. The shift in focus back to the early eighteen-forties pulls the text away from traditional Darwinian echoes, or even from methodological geological debates of the 1860s. Instead, Owen's *dinosauria* and the reforming and outright suppressive forces of British science and natural theology are lifted up. Dickens reproduces new science stories of transcendental anatomy and Geoffroyan morphology; none of which ever dominate a narrative that never resolves itself. Similarly, Eliot's *Mill* jumps back from its 1861 point of authorial intention and textual publication to the original story setting of the 1820s and 1830s. The oft maligned figure of the flood makes more sense in the context of diluvial geology and the divided narrative structure seems to reproduce Lyellian actualist geology where human reason and the natural world are coexistent in two different times, the ahistorical world of nature, and the progressionist one of the human mind. These are clear examples of how this approach has indeed succeeded in producing new knowledge and a more nuanced evidence base for further study.

Mary Shelley's *The Last Man* acted as a test case in the overall study. Without a clear chronological refocusing of the history of science involved, *The Last Man* provided opportunities to explore the relationship between narratives in science and literature. *The Last Man* resists the imposition of a

three-tiered narrative model of fabula, story and text. However, the focus of the frame narrative is firmly anchored in 1818. This does not radically change my analysis in terms of the history of science involved. However, it does allow separation from criticism reading authorial intention and biography, in addition to reader reception and the history of publication. Sterrenburg's reading of the politico-historical aspect of *The Last Man* as an anatomy of failed revolutions initiates my understanding of the novel as detailing a similar anatomy of science and theories of the earth. Lamarckian strands interrogate Sterrenburg's political anatomy, while Huttonian eternalism and Cuvierian theory produce new models of nature that are tested in a "rhetoric of spectacular display".[132] But both the political and scientific modes fail to produce any effective model for the human world or nature in *The Last Man.* Instead, the book becomes an exercise in novelistic method in reinterpreting and retelling biblical, political, and scientific modes; all of which represent failures in representing true history. Just as Shelley tests and rejects different genres within the instability and need for originality of the novel. Shelley makes the narrative process itself a test of both scientific method and textual replicability through different form and genres. In the process, the empirical quest for, and test of, truth ultimately fails. Primarily because their very modes, as that of the novel, are designed to produce the particular. In this sense, the book purely reasserts its own method in privileging "the primacy of individual experience".[133] Ultimately, the spectacle of utopian and dystopian visions of both human and natural worlds are subordinate to the world of the individual.[134] Moreover, that world of the individual subject in *The Last Man* is witness to the external processes of history. The anatomy of political change, that in our case interact with Lamarckian transformist zoology, and the geological science stories of Cuvier and Buckland, produce similar stories in the novel. But any resolution of the epistemological premise of the novel is to be found in its method and system of narrative which tests truth claims through a process novelistic empiricism. The result is a simple reaffirmation of process, where the only truth is the instability and unreliability of narrative itself.

The Mill on the Floss produced strong results in refocusing historical attention. Criticism in literature and science studies had traditionally drawn attention to Darwinian models in Eliot.[135] Later criticism from historians of science, in contrast, questioned the use of the geological models

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[132] Secord, *Victorian Sensation,* 439.

[133] Watt, *Rise of the Novel*, 15.

[134] Bailes, "The Psychologization of Geological Catastrophe", 672.

[135] Beer, *Darwin's Plots*; Shuttleworth, *George Eliot*; Levine et al

of uniformitarianism and catastrophism, highlighting issues of actor categories the reproduced nineteenth century rhetoric.[136] However, one result of later critical work within history of science is that attention has been refocused to the period of text publication due to a historicist emphasis of reader reception and book history. While this is a legitimate area of research, I aimed to return to the scientific context of *Mill's* story in the 1830s. This draws focus away from Darwin and to proto-evolutionary or pre-Darwinian models of science, while renouncing the original actor categories and the relationship of practitioners involved. In fact, I argue that Lyell and Cuvier who produced the science involved in the British uniformitarian and catastrophist public debate are closely aligned in their empirical methods. The emphasis on narrative, and, in turn, the context of the story, allows me to put Cuvier's science into context in the 1820s and 1830s. This, in turn, produces significantly different historical actors. Of course, Buckland, Lyell and Lamarck have all been addressed in literary criticism of *Mill* before. But the nuanced heterogeneity of practices and actors presented as a result of a historicist approach helps focus attention away from other contexts predominantly based of Darwinian evolutionary models.

Mill, I have shown, incorporates competing science stories in its attempt to understand the natural and human world within it. Moreover, that Cuvier is central to all these science stories in Britain through the different practitioners and their respective internecine struggles. The particular discourses I identified in *Mill* were, first, Buckland's Bridgewater project and its conservative natural theology; second, Lyell's actualism and its separation of human reason and the natural world; and, third, Lamarckian morphology that produces progression in the human world. In addition to more recent critical readings of Lyellian geology as "anti-narrative"[137] and its use in literature as "geological breakdown" in producing problems for plot[138], I have argued that Cuvierian anatomy plays a complementary role in producing plot. Moreover, that this position finds agreement in Dawson's suggestion that palaeontology is an equally plausible model for nineteenth century serialised fiction.[139] There are interactions between the science stories and *Mill* as novel. Eliot, writing in the 1860s, does not experiment with genre as Shelley in the 1820s. But *Mill* engage in the same pursuit of truth by superimposing and juxtaposing competing models for nature and the human world. The divided narrative structure reproduces a Lyellian division of natural world and

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[136] Buckland, *Novel Science.*

[137] Secord, *Introduction*, xviii.

[138] Buckland, *Novel Science*, 26.

[139] Dawson, "Literary Megatheriums", 208.

human reason. However, this does not benefit our protagonists as they are eventually helpless against the flood story line, which, I have argued, represent the repressive and conservative diluvialist project of Bridgewater that combat Lamarckism progression at very turn. Eliot emphasises the unreliability of narrative and both the textual and scientific genesis of the story. Characters struggle to become individualists in a novel world, but rather lapse into degeneration or extinction at the hands of repressive dominant ideology. The morphological issues that produce plot are an attempt to escape the constraints of traditional plots whether theories of earth, or the biblical account, or political repression. In many ways, the lack of resolution of the progressive human narrative juxtaposed the non-progressive natural world means *Mill* reproduces much of the scientific structure of *The Last Man*. Eliot similarly engages in a project skeptical empiricism where she presents her story as fact, while simultaneously reminding her reader of the unreliability and underlying instability of her narrative. Moreover, her novelistic method is the only possible way of resolving human, natural and individual worlds, both for the novelist and for the novel's characters. However, the relationship of science in the 1830s and the novel as published in the 1850s seems incongruous and produces its own set of problems.

Dickens's *Bleak House* is reappraised in terms of the early 1840's science in which it is set. This produces a rich pre-Darwinian variety of proto-evolutionary science stories with Cuvier placed firmly at its centre. The acceptance of geological anti-narrative and breakdown combined with Dawson's paleontological model for nineteenth century fiction represent a successful reading strategy for Dickens and *Bleak House*, I have argued. The novel is brimming with tension between Grant's Lamarckian biology and Owen's transcendental anatomy, which emerges as an idealist alternative to proto-evolutionary models' growing legitimacy. The *megalosaurus* image at the novels head, is revitalised into a clear dramatisation of Owen's invention of the dinosaur in early 1840's Britain. I have suggested that this political and ideological work, on Owen's part, represents a brutal and repressive reassertion of natural theology and the political status quo it privileges. But *Bleak House* also constitutes a shift in the relationship between science and literature, in particular circumstances specific to its context. It represents the world as a novel, to a degree in which *Mill* and *The Last Man* did not. The novel is a physical object and symbol in the text. The world is recreated only through the textual artefact, and any possible progression in the world is, again, initiated by the text. The theme of connexion is endlessly restated and investigated in the text and by the textual practice of the author. The subject and method of the novel are united in practice. They both follow scientific and textual modes of investigation rooted in empiricism in pursuit of truth and "true history". None of the science stories that produce new models for nature resolve

themselves or emerge dominant. None of the characters in *Bleak House* succeed except by achieving textual and scientific empirical particularity and individualism. In other words, their success in the novel is predicated upon them becoming novel-like expressions of characters in their originality and rejection of the traditional plots ascribed them. This is in sharp contrast to Owenite transcendental anatomy which sets up an essentialist system of archetypes allowing transition and movement *within* type, and, moreover, within a fixity bound to a Gothic and brutally repressive natural theology.

In this sense, I argue, Dickens represents a site of meaning at the points of authorial intention and reader reception whose instability is greater than that of Eliot. The transcendental anatomy of Owen continues to counter Darwinian evolutionary models through the 1860s. But *Mill* seems to set its focus back thirty years to the 1830s. These contextualities are critical in any further study of this area. In this study, I have demonstrated the centrality of Cuvier to British science in the first half of the nineteenth century and that science's role as a model for nature, and for the human world, as well as informing the unstable systems of narrative characteristic of the novel genre and form; instability being one of its chief characteristics. I cannot answer my fourth research question of relationship of the narratives and literature and science in any greater historical perspective. However, important conclusions can be drawn about the particular circumstances of particular times and places.

Cuvier's *Essay* initiated a lasting period of scientific centrality and legitimacy at the centre of British science and its representation in British novels in the first half of the nineteenth century. I have examined the 1810s and 1820s when Cuvier was incorporated into the cultural hegemony of Buckland's geological diluvialism, but also into the Lamarckian political resistance as mischievously dramatised by Byron in *Cain.* His law of correlations applied to geology made his science both an important narrative and analogous to the empirical truth-seeking mode of the novel. *The Last Man* deploys narrative modes of scientific and textual inquiry to test the veracity of political utopias and scientific theories of nature. In the 1820s to 1830s, Lyellian actualist geology incorporated Cuvier to challenge Diluvialist and their natural theology. Lyell's "anti-narrative" separated human reason and an ahistorical eternal natural world. Both in turn resisted the radical upsurge of Lamarckian biology. *Mill* plays out a brutal, repressive narrative of the conservative ideology of natural theology in counteracting progression and change. Eliot adopts similar skeptical empiricism as a novelistic approach. Moreover, her characters fail to successfully adapt to the novel

form and become successful novel characters with “primacy of individual experience”.[140] This internalisation and individualisation continues in *Bleak House* set in the 1840s. Dickens engages a form of porto-magic realism where the transcendent allows Gothic movement and morphology between taxonomic lines and divisions; but at the ultimate price of fixity and lack of progression, and even extinction. The paleontological process becomes both a model for organic unity in Victorian fiction and a mode of narrative production.[141] In sum, Cuvier’s science and its discourse both produce and are reproduced in nineteenth century novels.

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[140] Watt, *Rise of the Novel*, 15.

[141] Dawson, “Literary Megatheriums”, 208.

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